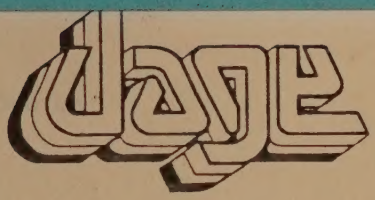

BT22
Technical Manual

MP MASTER
MA32756

VERSION 1 JANUARY 1984

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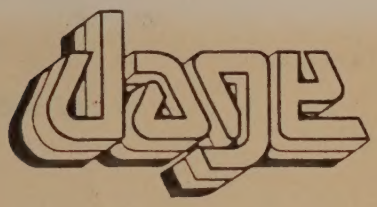

BT22
Technical Manual

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BT-22 M I C R O T E S T E R
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1. INTRODUCTION

The BT-22 is designed to provide semi automatic testing of bond strength by either destructive or non destructive means. The test piece is rigidly anchored to the base of the machine and the load is applied by a thin beam and hook, raised on a linear table, by a leadscrew and motor. Attached to the beam is a strain gauge network which registers and records the load electrically. The load is registered on a liquid crystal display and also as a permanent record on a paper print out system. For different load ranges e.g. 0 - 20 gram, 0 - 50 grms, 0 - 100 grms, etc., the beam, complete with a strain gauge, is interchangeable.

A range of interchangeable load cartridges is available from 0 - 5 grms up to 20 Kgms in three basic forms, one using a hook for pulling, another a tweezer grip and the third, a flat tool for shearing.

When using shear cartridges it is necessary to fit the vertical slide microscope accessory (Fig.10), in order to view the full 2 inch vertical working area.

2. SERVICES REQUIRED

1. Electrical

220 - 240 volts A.C. 47 - 63 Hz 630 mili amp

OR

100 - 110 volts A.C. 47 - 63 Hz 1.25 amp

2. Vacuum

20 ins Hg (500 mm Hg) minimum.

NOTE: Correct fuse must be inserted and voltage selected prior to switching machine on.

3. INSTALLATION AND SET UP

1. Unpacking

If the machine has been air freighted or delivered by carrier, the consignment will arrive in one packing case. The machine will be broken down into the following assemblies:-

1. Main machine
2. Microscope body
3. Microscope mounting arm
4. One box for each load cartridge
5. One box for all of the workholder adaptor plates
6. One box for each workholder
7. One box for all load tools
8. One Manual for BT-22 Microtester

2. Assembly

1. Take the main machine and remove the cover.
2. Check all Printed Circuit Boards are pushed fully into their edge connectors.
3. Replace cover.
4. Select correct voltage on back of panel and fit matching fuse as specified on service panel.
5. Connect vacuum supply to rear of machine.

6. Fit mains plug to suit local supply and connect.

7. Press 'Power On' switch on front panel.

8. Press 'Printer On' switch on front panel.

9. Lift paper clamp lever found on front panel. (Fig.2)

10. Remove printer door and load paper strip under roller and out over top of roller under print head. (See A4-14245).

    The paper is more easily fed if it is cut off at an angle and the roll is not inserted into its receptacle. (Fig.6)

11. Reclamp paper by lowering lever.

12. Place paper roll in its receptacle behind front panel, take up slack and replace printer door. (Fig.7)

13. Press 'Paper Advance' switch on front panel to ensure paper feed is correct.

14. Assemble microscope onto machine with spigot adaptor supplied or with microscope 'Z' stage accessory (Fig.10) if using WH6 or WH3 for vertical shear test.

4. OPERATIONAL CONTROLS, INDICATORS AND CONNECTORS

4.1. Front Panel Controls (Figs 1 & 2)

4.1.1. Power on Switch Function:- Main electrical supply with illuminated L.E.D.

4.1.2. Printer On Switch Function:- To give paper print readout, reset test number, and clear data used for analysis.

4.1.3. Paper Feed Switch Function:- To feed out paper continuously without printout.

4.1.4. Destruct/Non Destruct Switch Function:- To select destruct/non destruct test mode.

4.1.5. Digital Thumbwheel Function:- To select maximum permissible load to be applied on non destruct test, and for destruction testing, to set reference level above and below which results will be indicated on analysis.

4.1.6. Loading Rate Knob Function:- To adjust test speed of beam.

4.1.7. Stepback Switch Function:- In 'Off' position, load cartridge will stop when non destruct load or specimen failure is reached. It then requires the operator to drive the cartridge back to datum. In the 'On' position, load cartridge will stop at non destruct load or specimen failure, dwell momentarily (this time is a preset adjustment RV2 or PC320) then return automatically to datum. The stepback datum will depend upon whether destruct or non destruct mode is being used.

In non destruct mode the arm will step back to Lower Limit.

In the destruct mode the arm will step back to the Loop Limited (or Lower Limit if it is coincident with the Lower Limit).

The arm will not step back if -

(i) the Loop Limit is higher than its present position.

(ii) the test was not completed before reaching the top stop.

4.1.8. Printer Header Switch Function:- Prints Time, Part Number and Lot Number for clear record.

4.1.9. Data Analysis Switch Function:- Prints out statistical analysis of tests of last batch. (Data cleared by turning off 'Print On' switch, or by changing the Load Cartridge.)

4.1.10. Chuck Switch Function:- Applies vacuum clamping on chuck base.

4.1.11. Upper Limit Switch Function:- Sets upper limit of arm movement. Automatically sets at 'Power On' to the maximum of vertical movement allowed by BT-22. To over-ride a previously set 'Low' limit, hold the Limit Switch in and move the 'Z' paddle upwards, then release switch at new height.

4.1.12. Lower Limit Switch Function:- Sets lower limit of arm movement. Automatically sets to current arm position at power on.

4.1.13. Paddle Control Function:- Raises or lowers arm by elevation or depression. Speed of movement of arm is proportional to deflection of paddle. Button on end of paddle starts and aborts test if necessary.

4.1.14 Stitch Test Switch Function:- Allows indication of test failure should test load fall by 3% of maximum cartridge value during test.

Used for testing bonds where failure of a stitch bond would not necessarily be shown as a normal test failure.

4.1.15. Loop Limit Switch Function:-

Non Destruct Testing:-

To detect wire loops that are higher than a previously set permissible limit. To set loop height press 'Loop Limit' at appropriate height. BT-22 must be calibrated before this facility can be used. See Section 6.

Destruct Testing:-

At power on this limit is set to same value as Lower Limit. If the Lower Limit is moved downwards then the Loop Limit remains the same. If the Lower Limit is raised the Loop Limit moves with it. The Loop Limit cannot be lower than the Lower Limit.

In destruct mode the Loop Limit can be set to a height that the arm will step back to i.e. a search height.

To cancel set Loop Limit press Non Destruct switch. This will automatically set Loop Limit to Upper Limit for Non Destruct Testing and Lower Limit for Destruct testing.

4.2. Keyboard

4.2.1. Category buttons '0' to '9', when depressed will operate the printout and code the result with the corresponding number.

4.2.2. The button marked '*' is used by the operator to over-ride the automatic load sensing, which protects the hook from accidental damage when the operator is manually driving the head up

and down. This is required when due to operator error the machine has become locked and cannot be driven up or down. For example, if a non-destruct test has been selected without step back and the arm has come to rest at the non-destruct value, a further push of the test button will start a second test. The machine auto zero's and the arm attempts to move, but detects a load and stops. Now if the Z paddle is depressed, the arm starts to move down, but again detects a load and stops. The system is now locked and cannot go up or down. To restart the movement depress and hold the starred button '*' and depress the operating paddle. The arm will then move down to release the load tool.

The '*' button is also used for cancelling entries when used with '#' See Section 6.1.18.

4.2.3. The '#' button is used to enter test routines, and to cancel entries, see Section 6.

4.3. Connectors

4.3.1. Front Panel Connector. Connects load cartridge to main machine.

4.3.2. Rear Panel 24 way Socket* Provides an IEEE 488 connection.

4.4. L.C.D. Display

Two rows of 20 characters displayed to give test results, error status and machine use information.

4.5 Bulkhead Hose Connector

Pipe connector for vacuum chucks to take 5mm o.d. and 3mm i.d. PVC hose.

4.6. Printer

NOTE - All connectors marked * will require the appppropriate PC316 option.

5. MACHINE SPECIFICATION

5.1. Load application rate - Variable form 0% to in excess of 50% of maximum rated cartridge load per second.

5.2. Load cartridge range of movement - 2 1/2 inches (6.25 cm).

5.3. Raise/Lower rate - Variable between .010" per second (.25 mm per second) and .240" per second (6.0 mm per second).

5.4. Print output - 4 digit Test Number
3 digit load figure with floating point.
Single digit bond failure mode classification 0 - 9 and 'Dest'.
Asterisk and 'OK' for NDT limit confirmation.
'>' followed by the Load Cartrdige in use if a test exceeds the maximum load value.
'OVERHT' for overheight test.
'ERASED' for erased test.

5.5. LCD Display - 2 rows of 20 characters gives a reading of test result in appropriate units and fault status of machine. Also gives readout of test functions.

5.6. Bond failure code - Figures 0 - 9. Inititated by operator on keyboard in base of machine.

5.7. Variable time delay - on reaching NDT load before hook steps back.

5.8. Step Back feature.

5.9. Overheight Loop detection

5.10. Stitch test failure detection

5.11. Resolution +/- 0.5% of load cartridge size.

6. OPERATING INSTRUCTIONS

6.1. Using the Machine

6.1.1. Switch on (do not move arm paddle until the machine has initialised as the paddle reference is taken at this time) and allow electronics to stabilise for five minutes before use.

6.1.2. At power turn on the lower limit of the arm is set at the current position of the arm, inhibiting further movement downwards. The upper limit is automatically set to the upper limit of movement allowing the arm to be moved upwards using the paddle. To move the arm down hold depressed the LOWER LIMIT switch whilst at the same time depressing the operation paddle. On releasing the limit switch, the new lower limit will be set. The upper limit can be set, if required, by pressing the UPPER LIMIT switch at the desired height. The limit is set when the switch is released.

NOTE:- The speed of arm travel is dependant on the angle of elevation or depression of the paddle. Should the load tool meet any resistance, in either direction, the arm will stop.

6.1.3. To set upper and lower limit position, carry out 6.1.2. above and press and release LIMIT buttons when desired position is reached.

6.1.4. If non-destruct test is required press N/D TEST switch and set non-destruct load on thumbwheel switches.

The calibration of the thumbwheel switches is dependant on the load cartridge used and the following table indicates the ranges:-

Load Cartridge Range	Thumbwell Switch Increment
5 - 100 grms	.1 grm
200 - 1000 grms	1 grm
2 - 10 Kg	10 grms
10 - 20 Kg	100 grms

The accuracy of a Load Cartridge i +/- 0.5% of the maximum load e.g.:-

20 grm Load Cartridge resolution +/- 0.1 gm
50 grm Load Cartridge resolution +/- 0.25 gm
100 grm Load Cartridge resolution +/- 0.5 gm
20 Kg Load Cartridge resolution +/- 0.1 Kg

It is therefore possible to set the thumbwheel to a greater precision than the load cartridge resolution when using a 50 or 100 grm load cartridge (including multiples). To overcome

this problem the BT22 automnatically rounds down the thumbwheel setting to the nearest valid value, e.g.

20 gm Load Cartridge - (no change) XX.0, XX.1, etc.

50 gm Load Cartridge - XX.0, XX.3, XX.5, XX.8

100 gm Load Cartridge - XX.0, XX.5

The values displayed by the printer or display are rounded-up, hence the 0-3 and 0-8 readings when using 5X range load cartirdge. The values printed are used for calculations performed when a Data Analysis is requested.

If a non-destruct test is selected and the thumbwheel switches have been set to a value greater than the maximum permissible load for the cartridge, then an error message will be displayed. If the printer is on then a load greater than the load cartridge will be recorded during a destructive test if the maximum load reached is greater than the load cartridge. If Step Back is selected, the BT-22 will step back to the lower limit, when the maximum allowed load is reached.

6.1.5. If auto step back to lower limit is required after test, press 'STEP BACK' switch.

The arm will automatically stop moving down if the load cartridge encounters an obstacle.

This may also occur if a load cartridge beam is oscillating e.g. after a wire break. The arm will continue to step back whenever the apparent obstacle, due to oscillation about its zero position disappears. If the situation continues for greater than a preset time then the step back will be aborted requiring the arm to be moved down using the paddle.

6.1.6. If print out is required, press 'PRINT ON' switch.

6.1.7. If a printed heading is required see 4.1.8., press 'PRINT HEADER' switch.

6.1.8. Set Load Rate. This controls the rate at which the load is applied by the cartridge. (The rate should be set to give optimum test time and to suit the load cartridge selected).
NOTE;- High test rates can give rise to over-shoot. In the non-destruct mode, the load rate control will only function over the lower part of its range if the thumbwheel setting is very low. The Load Rate range is automatically divided by 8 when used with a low deflection cartridge. This prevents the applied load being greater than the permissible maximum for these cartridges.

Fig. 21 shows the speed of the load cartridge elevation during test plotted against the load rate setting. N.B. See section 8.7 - self tests for establishing ditial value of load rate setting.

6.1.9. Load Test Piece.

6.1.10. Engage hook using arm movement paddle adjusting chuck in X-Y and Theta.
It is advisable to have some clearance between hook and wire as test may be aborted if hook registers an increase in loading within the first .003 inches of travel.

6.1.11. Switch on vacuum clamp to chuck, if applicable.

6.1.12. Press test button on paddle to start test.
If the bleeper immediately sounds then the test will have failed to start and an error message will be displayed (See Section. 7. Error Messages).

6.1.13. If the test is successfully initiated, the tool will move into engagement with the test piece at a speed determined by the Load Rate Setting (see 6.1.8.) The signal from the load

transducer is digitised into 1000 steps (or counts) over its range and a test piece failure (whether working in "Destruct" or "Non Destruct" Mode) will be signalled if the counts move above a threshold value and then drop back to 5 or less (N.B. Machine accuracy +/- 0.5%, i.e. 5 counts).

It should be understood that at all times the machine is recording and holding the peak output from the Load Cartridge and the display is showing - in real time - the load on the test tool. When a failure occurs before the threshold value is reached, the test cycle continues until either the operator stops the test of the "top stop" is reached, however, the max load seen by the load transducer (i.e. the "destruct load") is held in memory and can be printed and displayed following a 'grade 0' input at the keypad. The test number is incremented and data is included when analysis is requested. N.B. There is no forced grading when failures occur below the threshold. It is always necessary for an operator to observe the failure and decide whether or not to invoke a record under 'grade 0'. Bearing in mind that a badly positioned tool could lead to a mis-test,

from which a small force (below the threshold) could be detected by the Load Cartridge and that this may want to be discarded.

A Load Cartridge range determines its 'threshold' value. The table below sets out the dimensions and indicates the force under which any one L.C. type requires a subjective 'grade 0' input.

L.C. RANGE	THRESHOLD COUNTS	EQUIV THRESHOLD FORCE	RESOLUTION
0 - 5g	15	0.08g	0.03g
0 - 20g	30	0.6g	0.10g
0 - 50g	15	0.8g	0.30g
0 - 100g	10	1.0g	0.50g
0 - 200g	30	6.0g	1.0g
0 - 500g	15	8.0g	3.0g
0 - 1Kg	10	0.01Kg	5.0g
0 - 5Kg	15	0.08Kg	0.03Kg
0 - 10Kg	10	0.10Kg	0.05Kg
0 - 20Kg	30	0.60Kg	0.10Kg

The foregoing description varies when the machine is operating with STITCH TEST mode engaged (see section 6.3). A stitch test failure cannot occur below the count 'threshold' of a Load Cartridge, therefore the subjective 'grade 0' must be input in applicable.

6.1.14. On a non-destructive test, the print out will be automatic if the wire on test piece does not fail. Print out of a failure can be initiated by pressing any of the keys numbered 0 to 9. This is useful for categorising the type failure. If the step back feature is used, print out occurs after head has returned to start. If it is not used, it will print out at end of test with hook on tool still touching specimen. Successful non-destruct testing will be indicated by dimming of the illuminators, and an audible bleep.

NOTE:- If specimen fails at set non-destruct load, print out will not indicate pass. It will be necessary to press a category button 0 to 9.

6.1.15. If step back feature is not used, head must be driven down to lower limit before next test can commence.

6.1.16. If printer is switched on and failure occurs then a fail code must be printed before a further test can commence. An error message will indicate this.

6.1.17. A test can be stopped by pressing test button a second time.

6.1.18. If a test has been cancelled it is possible to grade this test as category 0. This is useful if a wire is already broken or not present. A 'Test' graded in this manner can only be erased, and not regraded.

6.1.19. To erase a test, press '#' button followed by '*' button, which will erase that test from the stored data. The print out will indicate 'ERASED' test. A destruct test result must be graded before it can be erased. An error message 'GRADE LAST TEST' will be displayed when the printer is switched on.

6.2. Use of the Loop Limit Switch

In the destruct mode the Loop Limit switch may be used to select a step back level which can be used as a safe 'search height'. It will be higher than or equal to the lower limit set, and can be selected by pressing the Loop Limit switch at the desired level before the test commences. The setting can be cancelled by depressing and releasing the Non-Destruct switch. At power on the Loop Limit height is set coincident to the lower limit.

In the non-destruct mode the Loop Limit switch may be used to set a maximum level for wire loop height which, if reached, will be indicated on the readout.

To select, bring the hook to the maximum permissible level and press the Loop Limit switch.

Any test which goes overheight will not be aborted but will be indicated on the L.C.D. and the printout.

IMPORTANT - Before the overheight facility can be used the beam must be calibrated. If overheight testing is not required then it is not necessary to perform this calibration. The calibration procedure should be performed whenever a new load cartridge is used due to the variation in deflection per unit load of the beams.

The load cartridge to be calibrated should be connected and have a suitable hook. Place the hook such that when the arm moves upwards it engages against a solid fixed object. The fixed object should not permit the hook to slip during the calibration procedure. It is necessary to align the hook before entering the calibration mode.

The calibration procedure will automatically be repeated. The lower limit should be set at a safe height as the arm will step back in order to start the second test.

To enter Calibration mode, press the '#' key followed by 3 - the BT-22 will then display - 'O-HEIGHT CALIBRATION PRESS TEST TO CONTINUE'.

Press the Test button to start the calibration routine - the arm will slowly move up until a fixed load is present on the beam, step back and repeat. If calibration is successful the message 'CALIBRATION COMPLETE' will be displayed and accompanied by a short 'bleep'. If an error is detected 'CALIBRATION ERROR-PRESS TEST TO CONTINUE' is displayed. To exist calibration mode press '#' or Test button.

6.3. Use of Stitch Test Switch

To detect destructive failures of stitch bonds press the Stitch test switch in either destructive or non-destructive mode.

A reduction of 30 counts, (3%) of the selected load cartridge range during test will be registered as a destructive test. This will indicate a possible stitch bond failure. To continue testing the failure must be graded.

6.4. To Reset Test Count

To rest test count number, switch PRINTER ON switch off, then on again and the next test will be 1. This is done automatically when a new load cartridge is connected to the BT-22. If the printer is on and the maximum test number (9999) is reached, an error message is displayed and further tests inhibited.

6.5. To print data analysis of test results

Press DATA ANALYSIS switch.

Initiation of DATA ANALYSIS does not reset test back to 1. To clear statistical data and reset test count to 1, turn printer off then on again. If this is not done additional test data will be added to existing test data. For details of DATA ANALYSIS see the examples on the following pages.

```
----------------------
MICROTESTER BT-22
DATA ANALYSIS
----------------------
TIME 09.13  1 MAR'87          Time and Date
PART NUMBER
LOT NUMBER                    Customer's own record written here

4 TESTS  (TOTAL)              Total No. of Tests

DESTRUCTIVE TESTS
----------------------
4 DESTRUCT TESTS              Total No. of Destructive Tests
10.4 gm MEAN LOAD
0.75 gm STD DEV               Standard Deviation (Population)

8.89 gm X-2*STD DEV           Confidence Level - 95% of all tests will
                              be greater than this value.
9.4 gm MIN LOAD
11.5 gm MAX LOAD

UNDER PRESET LOAD
1 TESTS <10.0 gm              No. of results less than thumbwheel setting
OVER PRESET LOAD
3 TESTS > 10.0 gm             No. of results greater than or equal to
                              thumbwheel setting.
DEST CODE  0
1 TESTS
10.2 gm MEAN LOAD
0 gm STD DEV

DEST CODE  1
1 TESTS
9.4 gm MEAN LOAD
0 gm STD DEV

DEST CODE  3                  Destructive Code Failure
1 TESTS                       No. of tests under Destructive Failure Code
9.4 gm MEAN LOAD              3.
0 gm STD DEV

DEST CODE  4
1 TESTS
10.5 gm MEAN LOAD
0 gm STD DEV

    4   9.4 gm DEST 1
    3  10.5 gm DEST 4
    2  9.4 gm  DEST 3
    1 10.2 gm  DEST 0
----------------------
```

TYPICAL DATA ANALYSIS OF DESTRUCTIVE TEST RESULTS

```
----------------------
MICROTESTER BT-22
DATA ANALYSIS
----------------------

TIME 14:20  6 MAY'83
PART NUMBER
LOT NUMBER

13 TESTS (TOTAL)

NON DESTRUCT TESTS
--------------------

11 TESTS
8.0 gm THW SETTING
8.00 gm MEAN LOAD

DESTRUCTIVE TESTS
--------------------

2 DESTRUCT TESTS
4.4. gm MEAN LOAD
2.1 gm STD DEV

DEST CODE  6
1 TESTS
2.3 gm MEAN LOAD
0 gm STD DEV

DEST CODE  8
1 TESTS
6.5 gm MEAN LOAD
0 gm STD DEV

   13  8.0 gm  OK *
   12  8.1 gm  OK *
   11  2.3 gm DEST 6
   10  8.0 gm  OK *
    9  8.0 gm  OK *
    8  6.5 gm DEST 8
    7  8.0 gm  OK *
    6  8.0 gm  OK *
    5  8.0 gm  OK *
    4  8.0 gm  OK *
    3  8.0 gm  OK *
    2  8.0 gm  OK *
    1  8.0 gm  OK *
----------------------
```

Non Destructive Tests that failed i.e. Test 8, Test 11.

Population of failed

TYPICAL DATA ANALYSIS OF NON-DESTRUCTIVE TEST RESULTS

```
-------------------------
MICROTESTER BT-22
DATA ANALYSIS
-------------------------
TIME 14:38 6 MAY'83
PART NUMBER
LOT NUMBER

8 TESTS (TOTAL)

OVER-RANGE TESTS
2 TESTS > 20 gm              Test that exceed the maximum load value of
                             the test cartridge
DESTRUCTIVE TESTS
-----------------------
6 DESTRUCT TESTS
6.65 gm MEAN LOAD
1.02 gm STD DEV

NOTE
OVERRANGE TESTS NOT          Overrange results are not included in the
PRESENT IN THIS DATA         data analysis

4.60 gm X-2* STD DEV

5.2 gm MIN LOAD
8.2 gm MAX LOAD

UNDER PRESET LOAD
6 TESTS < 26.0 gm
OVER PRESET LOAD
0 TESTS > 26.0 gm

DEST CODE  3
2 TESTS
7.85 gm MEAN LOAD
0.35 gm STD DEV
DEST CODE  4
1 TESTS
5.7 gm MEAN LOAD
0 gm STD DEV
DEST CODE  5
1 TESTS
6.9 gm MEAN LOAD
0 gm STD DEV
DEST CODE  6
2 TESTS
5.8 gm MEAN LOAD
0.6 gm STD DEV

    8  5.2 gm DEST 6
    7  6.4 gm DEST 6          New Test 7
    7  4.6 gm ERASED          Test 7 erased
    7  4.6 gm DEST 4
    6  5.7 gm DEST 4
    5 >20 gm  OK *            Overrange test
    4 >20 gm  OK *
    3  8.2 gm DEST 3
    2  7.5 gm DEST 3
    2  7.5 gm DEST 3
    1  6.9 gm DEST 5
---B--------------------
```

TYPICAL DATA ANALYSIS INCLUDING OVERRANGE AND ERASED TESTS

```
-------------------------
MICROTESTER BT-22
DATA ANALYSIS
-------------------------
TIME 15:17  6 MAY '83
PART NUMBER
LOT NUMBER

6 TESTS (TOTAL)

NON DESTRUCT TESTS
-------------------------
6 TESTS
6.0 gm THW SETTINGS
6.06 gm MEAN LOAD

OVERHEIGHT TESTS
2 HIGH LOOPS                    No. of overheight tests that exceeded the
                                Loop Limit setting.

    6  6.1 gm OK *
    5  6.0 gm OK *
    4  6.1 gm OVERHT            Overheight test indication
    3  6.0 gm OVERHT
    2  6.1 gm OK *
    1  6.1 gm OK *
-------------------------
```

TYPICAL ANALYSIS INCLUDING OVERHEIGHT TESTS FOR NON-DESTRUCTIVE TESTING

6.6 To Set and Display Time

Press the '#' key, followed by the 2 button, this displays the time and date of the internal real time clock of the BT-22, allowing the time to be displayed for information or adjustment.

The time display is updated every minute while a colon flashes at 2 second intervals. If the colon is flashing then the displayed values have not been adjusted and will continue to be updated. To adjust the time first press the '*' key which will cause a cursor to appear under the hours. The cursor indicates which field, i.e. hours, month, etc., will be incremented and can be moved by repeatedly pressing the '*' key or keeping it pressed. The cursor will automatically re-appear at the hour's position after the year position. To change any time or date value simply press the 0 key and the value. Indicated by the cursor, will be incremented once by each button pressed or continually while the button is held down. Once any time or date value has been changed the colon will stop flashing, indicating that it will no longer be updated by the internal clock.

To enter the set time press either the '#' key or test button. The displayed time, with seconds set to zero, automatically sets the internal real time clock.

To check the time re-select Time Display mode.

To exit this mode, without re-setting the time, press the '#' key or Test button.

6.7 To change load cartridge (Fig.9)

Unscrew large knurled screw at top of arm and lower cartridge off the dowel pin location. Disconnect plug and lead to front panel. This is best done with the cartridge in the up position.

6.8 The use of LC30 Series load cartridges

The load cartridges listed below should be used in the 'Destruct' mode only to ensure accuracy of results.

Cartridge

LC30

LC31

LC32

LC33

LC34

The load rate full scale range is automatically reduced by one eighth when LC30 cartridges are connected.

6.9. The use of load cartridges LC12 and LC13. (TWEEZER HEAD) Load cartridges LC12 and LC13 can only be used with the BT-22 providing:-

1. There is a minimum of .003" 'slack' in the wire being tested.

OR

2. The lowest speed is selected and the tweezers are left open when the start test button is pressed. After test has been started, but before the tweezer jaws have cleared the wire

tail, the tweezers must be closed by the switch on the arm. The above procedures are necessary to prevent the BT-22 detecting a load on the arm within the first .003" of movement - thus aborting the test.

7. ERROR MESSAGES

1. No Load Cartridge

If a Load Cartridge is not connected to the machine, then this is indicated by the above message when the Test button is pressed. The BT-22 uses links in the Load Cartridge plug to identify the range and type of cartridge and their absence detects the above state.

2. Obstruction

Should the load cartridge beam see a load change, other than during a test, then the motor drive will be inhibited. An obstruction can also occur during Step Back if the beam is oscillating. The BT-22 will continue to try and Step Back, in order to overcome the appearance of the obstruction. The motor is disabled while the load exists, preventing damage, but continues to drive if, during a fixed time, the load disappears. This can give rise to a rapid turning on and off of the motor if the beam is oscillating. The arm will reach the Lower Limit unless 'Obstruction' has been displayed.

3. Load Detected before start of Test

A load detected by the Cartridge prior to the start of a test will display this message. This can also be due to vibration of the beam which is detected as a changing load.

4. NON-DESTRUCT Limit Set to High

This will be displayed at the attempted start of a Non-Destruct Test if the thumbwheel load setting exceeds that of the Load Cartridge maximum.

5. Faulty Load Cartridge

If the load cartridge output is not within the auto zero range of the BT-22 the above error message is displayed.

NOTE:- (1) This can occur if the strain gauge output connector to the Main Logic Microprocessor PCB is faulty or not connected.

(2) The zero offset adjustment of the load cartridge may not be set correctly.

(3) The beam has been permanently distorted.

6. Reached Top Stop

During a test the arm will move upwards until either the non-destruct limit is reached or a destructive test is detected. However, if the upper limit is set too low then the arm will reach the limit before completing the test and this message will be displayed. The test is automatically aborted when the upper limit is reached with no step back, if selected.

7. Over-Ht Calibration Value Invalid

In order to perform accurate loop height calculation the BT-22 has to be able to record the deflection of a beam per unit force. This information is determined by the calibration routine and stored in the battery back up RAM (Random Access Memory), for future use. This data is stored until new values are entered or the battery back up fails. The BT-22 stores the data in two sections of the memory. When the Loop Limit is set for overheight testing, non-destruct mode only, these values are

compared. If an error is found the above message is displayed indicating that the calibration procedure should be performed to correct the data that has been corrupted.

NOTE:- The BT-22 does not check the validity of the calibration value.

8. Low Deflection Cartridge OverHt Test Invalid

It is not possible to perform overheight tests with a Low Deflection cartridge and an attempt to set the height limit will display the above message.

THE FOLLOWING MESSAGES ONLY OCCUR IF THE PRINTER IS ON. (or IEEE TEST RESULT DATA IS TRANSFERRED).

9. Grade Last Test

This will be displayed if either a new test is attempted or a Data Analysis is requested immediately following a destructive test, indicating that a fail code category should be entered before continuing. The self test modes are also inhibited until a result has been graded.

10. Grade 0 Only

The BT-22 allows an entry on the print-out (or via the IEEE bus if fitted) as if a 'test' had been performed, for example on a missing wire bond. The result can be entered by pressing the 0 key only, any other key will cause the message to be displayed.

NOTE:- Grade 0 is always available to code a destructive test or re-grade a previous pass, however the test button has to be pressed to increment the test number. The test button can then be pressed to abort the test, if necessary, followed by the 0 key.

11. No Re-Grade

If a result has been erased it is not possible to re-enter a failure code category for that test. This message also occurs if, after a Data Analysis, a grade key is pressed before the next test.

12. No Test Recorded

This is displayed if an attempt is made to erase a result if it has already been erased, or no previous test has been recorded by the machine, i.e. at power on.

13. Maximum Test Number

The maximum test number is 9999. When this is reached, with either the printer on, or IEEE result transfer, the BT-22 will automatically abort the test until the printer is switched off and on clearing the data, or an IEEE command resetting the test number is received.

NOTE:- If a Data Analysis is required this should be done before the test data is cleared by the printer switch or the IEEE command.

BT-22 ERROR MESSAGES

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	Message	Reason	Action	Notes
1.	NO LOAD CARTRIDGE	The Load Cartridge Coding category has not been detected.	Connect Load Cartridge.	
2.	OBSTRUCTION	Object in path of beam. Beam not at 'electrical' rest position	Remove obstruction (Press * key followed by movement of the Z-paddle)	See 4.2.2.
3.	LOAD DETECTED BEFORE START OF TEST	Hook touching test specimen. Beam vibration.	Lower Hook. Repeat test operation	
4.	NON DESTRUCT LIMIT SET TOO HIGH	NDT Test attempted with limit set greater than Load Cartridge specimen.	Reduce NDT level or use alternative Load Cartridge	
5.	FAULTY LOAD CARTRIDGE	Damaged Load Cartridge. Zero offset requires adjustment. Faulty connection of strain gauge.	Check setting. Check connections (also connector to master processor - PC320).	
7.	Over Ht Calibration Value Invalid	The stored calibration value has been corrupted.	Calibrate Load Cartridge before attempting a test for over height loops	
9.	GRADE LAST TEST	Function not available until the last destructive test is graded.	Press appropriate failure category key	
10.	GRADE 0 ONLY	A 'Test' has not been performed by the BT22 and only a 0 category test can be recorded.	Press 0 key if required to enter as a valid test.	
11.	NO RE-GRADE	The last result is not available to be re-graded, i.e. after a Data Analysis.		
12.	NO TEST RECORDED	No previous test is available to be erased.		

	Message	Reason	Action	Notes
13.	MAXIMUM TEST NUMBER	The maximum permissible Test Number has been reached. (Only if Printer On or IEEE).	Switch printer off and on to rest Test Number (or via IEEE bus).	Perform DATA analysis before switching printer off if required.
14.	CALIBRATION ERROR	The self calibration procedure (over height tests only) has detected an error in the result.	Check that the hook cannot slip and repeat calibration	
15.	LOW DEFLECTION CARTRIDGE OVERHT TESTS INVALID	Attempt to set Overheight Test limit while using Low Deflection cartridge		Low Deflec-tion Cartridge cannot be used to perform over-height tests

8. ELECTRICAL CALIBRATION AND SELF TEST ROUTINES

The Microtester BT-22 is a very accurate testing system. Careful set up and calibration will reward you with dependable, repeatable test results.

The principale of calibration is to lift a known, accurate weight and adjust the reading until it is the same as the calibration weight.

Turn on the Microtester and WAIT FIVE MINUTES. There is a small tendancy for the reading to change slightly with local temperature so it is advisable to have the Microtester in its final location and temperature stabilized before calibration. We recommend placing the Microtester on a rigid, level, base for the most stable results.

8.1 Load Cartridge Calibration

8.1.1. Before calibrating the load cartridge it is necessary to ensure that the Load Cartridge Damper, where fitted, is not influencing the zero reading of the cartridge. Section 9.5. describes how to set the damper.

8.1.2. For maximum calibration accuracy choose a test weight equal to the maximum value for the load cartridge. A lower value will reduce the calibration accuracy.

8.1.3. We can supply a calibration kit of test weights together with a calibration hook.

8.1.4. Position the test weight so that the hook is not touching the loop but will pick up the weight when the hook is raised.

8.1.5. Set the Microtester in its destructive test mode, with a low load rate, then press the test button. When the test weight is hanging freely reduce the load rate to minimum.

8.1.6. Adjust the 20 turn trimpot, accessible through the hole in the right hand side of the load cartridge until the correct reading is obtained on the display.

8.1.7. Press Test Button to end calibration.

8.1.8. Repeat the procedure until consistent results are obtained.

8.2. Machine Calibration

In the unlikely event of the machine itself requiring calibration, say after a component failure, then it is easily achieved by using a recently calibrated load cartridge.

8.2.1. Set the machine in its destructive test mode with a low load rate.

8.2.2. Perform a test in which a calibration weight is picked up and note the reading.

8.2.3. Make a small adjustment to the 20 turn trimpot RV1 located on the upper edge of PC320 inside the machine.

8.2.4. Continue performing tests and adjusting RV1 until the correct reading is obtained.

8.2.5. This adjustment is not critical since the final calibration should always be performed on the load cartridge.

8.2.6. If any difficulty is experienced, or a recently calibrated cartridge is unavailable, then our service departments have test fixtures for re-setting calibration of the machine.

8.3. Motor Speed - PC322 (RV1,2)

To set the motor speed a calibrated oscilloscope is required.

8.3.1. Remove cover.

8.3.2. Using Self Test 1 (Section 8.7) check that the Load Rate control just gives a displayed reading of 0 at 0% Load Rate, indicated by the front panel scale. Adjust the knob on the spindle if necessary.

8.3.3. With the Load Rate set the '0' start a test using a Load Cartridge or a Test Box.

8.3.4. Adjust RV2 (PC322) until the motor just stops. Cancel test.

8.3.5. Connect an oscilloscope to TP1. (Speed Vane Sensor output). Set Load Rate to maximum.

8.3.6. Drive the arm up and down with the paddle and adjust RV1 (PC322) until the period is 0.4ms +/- 5%.

8.3.7. Repeat until no further adjustment is necessary.

8.3.8. Start a test and check that the Load Rate potentiometer gives a smooth adjustment of speed to a minimum period of 0.53ms +/- 10%

8.4. Hold Delay - PC320 (RV2)

The Hold Delay is the delay before a NDT is passed after reaching the preset load. This delay is set by the preset, RV2, on PC322 and each unit is approximately 15ms. The preset is normally set to 5.

8.4.1. Remove cover.

8.4.2. Using Self Test 1 (Section 8.7.) display the Hold Delay value.

8.4.3. Adjust RV2 (PC320) to the required value, usually 5.

8.5. Self Test Modes

Self Test functions have been built into the machine and can be selected as follows:-

8.5.1. Press the '#' button on the keyboard.

8.5.2. Press one keyboard button 0 or 1 dependent on the function required.

8.5.3. To restore normal working after test functions have been selected press either the 'TEST' button, or the '#' keyboard button.

8.6. Self Test 0

This displays a value between 0-255 for the Z paddle position and the A-D converter count from the beam's strain gauge output.

If the Z paddle is at rest then 0 will be displayed with a 'dead' zone symmetrically about the centre. When the paddle is raised a reading between 0 and 127 should be observed and when lowered, between 128 and 255.

The Strain Gauge reading is a continuous output in increments of 0.1% of Load Range. Readings are from 0 to 1000 positive, but if a negative deflection is applied readings will go from 047, 046, 045, etc.

8.7. Self Test 1

This displays the Hold Delay and the digital value of the Load Rate.

The Hold Delay is the delay before a non-destruct test is passed once the NDT limit has been reached. The range is 0 to 255 and each unit is approximately 15 ms.

The Load Rate is the converted value from the front panel control used by the BT-22 to set the motor speed, hence the load rate during a test. The normal range is 0 to approximately 96, however, if a Low Deflection Cartridge is connected, the limit will be 12.

9. MECHANICAL - Main Machine

9.1. Load Cartridge Carriage (See Fig.4).

This consists of a precision linear slide, running in adjustable pre-loaded bearings, driven by a leadscrew and single nut. The leadscrew is driven by a DC motor through a 90 degree worm reduction gear box. If any of these elements require adjustment, follow the procedure outlined below:-

9.2. To remove play from linear slide

9.2.1. Disconnect leadscrew nut from nut block by removing the two retaining screws (Fig.3).

9.2.2. Lower carriage down slowly.

9.2.3. By hand screw nut up the leadscrew to the top.

9.2.4. With carriage raised to its upper limit adjust the eccentric journals (Fig.4) to remove all play from carriage. Lower carriage and check for play at lower end of movement.

9.2.5. Recouple nut to nut block and check for alignment by running carriage up and down using motor drive.

9.3. Gearbox (Fig.5).

If adjustment is necessary, make sure the axis of the input and output shafts line up with the leadscrew and motor axis. It is also most important to have the axis parallel as angular misalignment gives rise to a noisy transmission.

9.4. Motor (Fig.3).

To service the motor, remove the two screws holding the motor mounting plate, disconnect the wires on back of motor and remove from machine complete with half of the Oldham coupling (Fig.5).

9.5. Load Cartridge Damper

On the 0 - 20, 0 - 50, 0 - 100 gm and 0 - 50 Kg, 0 - 10 Kg, load cartridges a damper is fitted to stop the pull hook oscillating after a test. This sytem is set by the grubscrew located in the top cover at the front of the load cartridge (Fig.9).

On the 0 - 5 Kg and 0 - 10 Kg arms only, a bottom limit screw prevents overstrain in the downward direction.

NOTE:- This system is factory set and should require no further adjustment. However, if adjustment is found necessary, this procedure should be followed:-

9.5.1. Press the '#' key followed by the '0' on the keyboard.

9.5.2. Screw grubscrew clockwise until the strain gauge output display starts to increase.

9.5.3. Stop and back off grubscrew anti-clockwise until display stops decreasing then continue turning anti-clockwise one turn.

9.5.4. Press test button or '#' key to reinstate normal functions.

9.6. Adjustment of Rotary Transducer

Should the rotary transducer (See Fig. 5) be removed or replaced, then it will be necessary to reset the movement centrally as follows:-

(i) Loosen the two clamp brackets holding the transducer.

(ii) Drive arm up and down to full extent of travel and rotate transducer until the upper and lower stopping points are equi-distant from the microswitches.

(iii) Tighten clamp screws.

10. ELECTRONIC SYSTEM DESCRIPTION

10.1 General (Drawing A3-18022 to A3-18027)

The BT-22, like the BT-20, has been designed for maximum reliability coupled with ease of maintenance. To this end wherever possible insulation displacement connectors and ribbon cable have been used for the internal wiring to reduce the complexity of circuit tracing.

The unit is controlled by a microprocessor, and where possible signal processing is done via the processor. Hence simplifying the hardware system. The only case when this is not possible is the load motor speed control, where a rapid response to load variation is required.

The majority of the hardware is concerned with converting analogue signals into suitable digital data for the processor, and converting digital data from the processor into analogue signals and high current drives.

The Thermal Printer and Liquid Crystal Display, LCD, are completely self contained with their own controlling circuitry. They interface to the processor via 7 and 8 bit data buses respectively with control lines. The Printer operates from a regulated 12V DC supply and has ten thermal elements which move in a scanning pattern across the thermal paper. The thermal

elements are energised by the controller in the correct sequence such that each element 'draws' two characters by a series of dot patterns. The printer accepts parallel data from the processor and a line is printed when the printer's character buffer is full or a Carriage Return is received.

The LCD can display 40 characters, again by a series of dots, in a 20 x 2 line format. The display requires a single 5V supply and is connected to the BT-22 via PC406 which contains the Contrast preset control and a pull-up resistor. Display control information, i.e. cursor position, cursor on/off, etc., is sent via the above mentioned data lines.

Information from Fail Code keys, Thumbwheel switches and Load Cartridge Coding is multiplexed onto a common 4 bit data bus, each source being selected as required by the microprocessor. The front panel switches, excluding mains and chuck, are connected to the processor via Peripheral Interface Adaptors, PIA's.

The transformer has two primary windings with 0-110-120V taps and four secondaries:-

0 - 24V AC	Motor, LED, Solenoid (Chuck vacuum)
15 - 0 - 15V AC	Printer, Analogue +/- 12V
0 - 12V AC	Dazor Lamp
9 - 0 - 9V AC	Logic (+5V), Analogue +/- 5V

The main supply is filtered as it enters the BT22 by a filter incorporated in the rear panel socket. The machine is protected by a fuse whose value depends on the primary supply in use:- 630 M/A Anti-Surge/240V, 1.2A Anti-Surge 100/110V.

A Servo Potentiometer provides a dc voltage proportional to the arm position using a toothed belt and pulley system. This analogue output, along with the Load Rate and Paddle position are multiplexed to the Analogue to Digital converter for use by the microprocessor.

The Motherboard, PC321, provides all the interconnections between the printed circuits, and the switches, printer, display, transformer, etc.

10.2. Power Supply & Motor Drive - PC322 (Drg.A2-17844)

The transformer secondaries (9-0-9V, 15-0-15V) are rectified and regulated to provide the logic and analogue circuitry supplies. The board contains 5 voltage regulators, mounted on a central heatsink, and their associated components to smooth the rectified supplies and prevent high frequency oscillation of the regulators. For example, IC5, 7805 +5V regulators -C7, 8 (4700uF - 16V) C15 (100uF, 25V) smoothing and reservoir capacitors C11, 12 (0.1uF) prevent high frequency oscillation.

The voltage regulators are:-

7805	+ 5 +/- 0.2V	Analogue
78H05	+ 5 +/- 0.2V	Logic Supply
7905	- 5 +/- 0.2V	Analogue
78H12	+ 12 +/- 0.5V	Printer, DG 508 (IC5 PC320)
7912	- 12 +/- 0.5V	DG 508 (IC5, PC320)

The 0 - 240V secondary is rectified and smoothed to supply the motor and solenoid, with overload protection by a 3A fuse. Resistor, R22 provides a load to dim the LED at 'Power Off' discharging C13.

The motor speed control is contained on this board and has two input signals:-

(1) The speed control voltage which is output by processor using a D-A Converter.

(2) The 'feedback' of speed information by an opto-sensor and a slotted disc which is fitted to the motor drive shaft.

The output of the opto-sensor, which is high when blocked by a vane, is squared up and inverted by IC1. The output negative edge is differentiated by C1 and triggers a timer IC2, (Pin 2). This gives a predefined pulse width output which is integrated by R11 and C3. Therefore, greater speeds produce more pulses and the integrated voltage on C3 rises. This voltage is compared with the required speed by IC3, (1,2,3) which

gives an error signal. A low amplitude triangular waveform is generated by IC3 (12,13,14) which is connected to an oscillator. This waveform on IC3 Pin 5, with the error signal on Pin 6, produce an output of pulses with a 50% mark space ratio if the error signal is zero. As the error signal increase the mark space ratio will alter hence giving more or less power to the motor, until either full or no power is applied, hence speed control. This 'motor drive' signal drives TR2 which connects the full supply voltage across the motor.

If the drive disappears for greater than a certain period of time sensed by D2, C4 and R16, then the comparitor IC3, (8,9,10) will switch. This signal turns on TR1 via IC9, (hex-darlington driver) and hence connects a 4R7 resistor across the motor to give dynamic braking.

The motor direction is determined by the state of relay RL1, which is controlled by the processor via a darlington driver. The relay exchanges the connections to the motor. The limit microswitches are connected in series with the motor so that drive is only inhibited in the offending direction i.e. if the arm hits the top microswitch the drive in the downward direction is not affected.

The dazor lamp is dimmed by removing half of the AC waveform across it. Diode D6, permanently provides one half of the cycle and the other half cycle is switched in or out by SCR1 as required.

The audible annunciator is driven by a darlington driver, (IC9, Pin 16) from a microprocessor control signal.

10.3 Microprocessor and Control Logic - PC 320 (A1-17845/6)

The components on this board are concerned with the analogue/digital - digital/analogue conversions of various signals and operation of the microprocessor along with its I/O (input and output) devices.

At 'power up' a reset signal is generated by TR1,2 and associated components, this resets the processor and initiates the power up sequence. A 1MHz clock is produced by the crystal and IC11.

The address bus is buffered by IC15 and IC16, while the bi-directional data bus uses IC27 when used with PC316 (Communications Board). The various I/O devices, EPROM (Eraseable-Programmable Read Only Memory) and RAM (Random Access Memory) are at addresses specified on the circuit diagram. The EPROM (4K x 8) consists of IC21, 22 and 23, and contains the operating programme of the system. The RAM is a CMOS 2K x 8 device which, due to its lower power consumption, is permanently powered by the battery back up system when the BT-22 is switched off.

The battery is a rechargeable nickel-cadmium type with a nominal voltage of 3.6V - 100 mAh capacity, and is trickle charged via R31. Transistors - TR3 and TR4,

are used to detect the Reset signal and when the BT-22 is switched off before the +5V logic supply falls. Relays RL1/2 are used to prevent the Clock, (IC26) and stored data in the RAM being corrupted during either of the above states.

Relay 1 is also used to isolate the supply to the Clock and RAM from the + 5V logic rail.

The Real Time Clock IC26, uses a 32.768 kHz - small crystal to provide an accurate time interval. The device is set and read by the processor via a serial link with a strobe, and three control bits.

The five PIA's IC7, 28, 30, 31, 32 provide the input/output lines between the microprocessor and the remainder of the BT-22, i.e. switches, printer, etc. The function of each device or control line is detailed on the circuit diagram, however in general the primary functions are:-

IC7 A-D Converter (Analogue Inputs)

IC28 Clock and LCD

IC30 Printer

IC31 F.P. Switches - 4 bit Data Bus (Keyboard etc)

IC32 F.P. Switches - Auto-zero (Strain gauge).

There are five analogue inputs, the Z - paddle, Position Transducer, Load Rate, Hold Delay (RV2) and Strain Gauge (Load Cartridge). These are fed into an analogue multiplexer, IC5, that switches between them in the following order:-

(a) Before Test
- (i) Z - Paddle
- (ii) Position Transducer
- (iii) Hold Delay
- (iv) Strain Gauges

(b) During Test
- (i) Position Transducer
- (ii) Strain Gauges
- (iii) Load Rate
- (iv) Strain Gauges

The Analogue-Digital converter, IC1, then measures the input value, that information is processed, the multiplexer is changed, and the next reading is taken, etc. The A-D converter requires a clock signal which is generated by IC3.

As the output from the strain gauge bridge in the Load Cartridge is so small, a method of setting zero, or nulling is required to cancel the offset voltage on the signal.

This is done automatically by the processor whenever the Load Cartridge is changed or when a test is started. The D-A Converter IC6, and IC4 (12, 13 & 14) provide an analogue voltage, proportional to the digital input 'value', to give an offset to the strain gauge amplifier IC4 (8, 9, 10).

The motor speed control voltage is generated by the D-A Converter, IC2, and IC4 (5, 6, 7).

11. LIST OF AVAILABLE OPTIONS

11.1. LOAD CARTRIDGES

A range of load cartridges are available for use with the Microtester comprising:-

DAGE BT-22 LC00	0 to 5 grams	Pull Cartridge
DAGE BT-22 LC01	0 to 20 grams	Pull Cartridge
DAGE BT-22 LC02	0 to 50 grams	Pull Cartridge
DAGE BT-22 LC03	0 to 100 grams	Pull Cartridge
DAGE BT-22 LC04	0 to 500 grams	Pull Cartridge
DAGE BT-22 LC05	0 to 1 kilogram	Pull Cartridge
DAGE BT-22 LC06	0 to 5 kilogram	Pull Cartridge
DAGE BT-22 LC07	0 to 10 kilogram	Pull Cartridge
DAGE BT-22 LC12	0 to 20 gram	Tweezer Pull
DAGE BT-22 LC13	0 to 200 gram	Tweezer Pull
DAGE BT-22 LC14	0 to 200 gram	Pull Cartridge
DAGE BT-22 LC28	0 to 100 grams	Ball Shear
DAGE BT-22 LC29	0 to 200 grams	Ball Shear
DAGE BT-22 LC30	0 to 500 gram	Pull Shear
DAGE BT-22 LC31	0 to 1 kilogram	Pull Shear - Low Overshoot
DAGE BT-22 LC32	0 to 10 kilogram	Pull Shear
DAGE BT-22 LC33	0 to 5 kilogram	Pull Shear
DAGE BT-22 LC34	0 to 20 kilograms	Pull Shear
DAGE BT-22 LC40	0 to 50 gram	Pull Cartridge with hook rotation
DAGE BT-22 LC41	0 to 20 gram	Pull Cartridge with hook rotation
DAGE BT-22 LC42	0 to 100 gram	Pull Cartridge with hook rotation

All the above cartridges are factory calibrated and no further adjustment should be necessary. However, if a calibration check is necessary then a known standard weight of a size suitable for the load cartridge to be checked should be weighed using the standard test procedure Section 8.1. - previously described.

If readout does not correspond to known standard weight then this may be adjusted by rotating the calibration potentiometer located in the right hand side of the load cartridge until weight and readout agree.

11.2. WORKHOLDERS

DAGE BT22 WH15	Heavy duty workholder for shear application, X/Y base unit.
DAGE BT22 WH1A	Horizontal work holder base unit. With vacuum clamp base. Suitable for pulling up to 20 kilogram.
DAGE BT22 WH1B	Horizontal work holder base unit. No vacuum clamp base. Suitable for up to 50 grams pull.
DAGE BT22 WH2	Variable angle, from horizontal to vertical.
DAGE BT22 WH3	Micrometer X-Y-O base unit with vacuum clamp base.
DAGE BT22 WH5	Work holder for Cerdip, top ceramic, torque shear testing.

DAGE BT22 WH6	Vertical work holder base unit for die shear. Vacuum clamp base.
DAGE BT22 WH7	Joystick control horizontal work holder base unit. Vacuum clamp base. For use up to 500 grams pull.
DAGE BT22 WH9	Vertical Workholder

11.3. ADAPTOR PLATES

DAGE BT22 AP01	Adaptor plate to suit T03 style headers.
DAGE BT22 AP02	Adaptor plate to suit T05 style headers.
DAGE BT22 AP03	Adaptor plate to suit T018 style headers
DAGE BT22 AP04	Adaptor plate to suit DIL packages, any row spacing up to 40 leads.
DAGE BT22 AP05	Adaptor plate to suit flatpacks up to 2 ins square (50 mm).
DAGE BT22 AP09	Adaptor plate to suit T08 style headers 0.5" dia.
DAGE BT22 AP10	Adaptor plate to suit Cerdip Cap Shear (WH 5 only). Customer to specify size. Options A to E.
DAGE BT22 AP11	Adaptor plate for substrates from 2 ins (50 mm) square up to 4 ins (100 mm) square.
DAGE BT22 AP12	Adaptor plate to suit T08 style headers 0.6" diameter.
DAGE BT22 AP13	Heated adaptor plate for up to 2 in x 2 in substrates. Temperature up to 300 degrees C. 240V.
DAGE BT22 AP13U	Heated adaptor plate for up to 2 in x 2 in substrates. Temperature up to 300 degrees C. 110V.
DAGE BT22 AP14	Adaptor plate to suit Dil packages 0.9" row space.
DAGE BT22 AP16	Adaptor plate for leadframe wire pull.

DAGE BT22 AP4A	Adaptor plate to suit DIL packages, universal holder.
DAGE BT22 AP4B	Adaptor plate for leadframe die shear.
DAGE BT22 AP8A	Adaptor plate for leadrame die shear up to 2.65". Max die pad 0.5".

11.4 LOAD TOOLS

DAGE BT22 LT001	Hook 0.001 ins (25 um) dia
DAGE BT22 LT1	Hook 0.003 ins (75 um) dia
DAGE BT22 LT10	Serrated jaw clamp for pull shear
DAGE BT22 LT120	Hook 0.003 ins (75 um) dia
DAGE BT22 LT121	Hook 0.006 ins (150 um) dia
DAGE BT22 LT1E	Spare swinging hooks 0.003 ins (75 um) dia
DAGE BT22 LT1S	Swinging Hook Assy 0.003 ins (75 um) dia
DAGE BT22 LT2	Hook 0.006 ins (150 um) dia
DAGE BT22 LT3	Hook 0.010 ins (250 um) dia
DAGE BT22 LT4	Hook 0.015 ins (375 um) dia
DAGE BT22 LT5A	Shear Loading Tool. Face width 0.050 ins (1.27 mm)
DAGE BT22 LT5B	Shear Loading Tool. Face width 0.075 ins (1.91 mm)
DAGE BT22 LT5C	Shear Loading Tool. Face width 0.100 ins (2.54 mm)
DAGE BT22 LT5D	Shear Loading Tool. Face width 0.125 ins (3.18 mm)
DAGE BT22 LT5E	Shear Loading Tool. Face width 0.150 ins (3.81 mm)
DAGE BT22 LT5F	Shear Loading Tool. Face width 0.187 ins (4.75 mm)
DAGE BT22 LT5G	Shear Loading Tool. Face width 0.200 ins (5.08 mm)
DAGE BT22 LT5H	Shear Loading Tool. Face width 0.225 ins (5.72 mm)
DAGE BT22 LT5J	Shear Loading Tool. Face width 0.250 ins (6.35 mm)
DAGE BT22 LT5K	Shear Loading Tool. Face width 0.300 ins (7.62 mm)
DAGE BT22 LT5L	Shear Loading Tool. Face width 0.400 ins (10.16 mm)
DAGE BT22 LT6	Shear Loading Tool. Ball Bonds
DAGE BT22 LT7	Hook 0.020 ins (500 um) dia
DAGE BT22 LT8	Hook 0.025 ins (625 um) dia
DAGE BT22 LT9	Hook 0.035 ins (750 um) dia

11.5. MISCELLANEOUS ACCESSORIES

DAGE BT22 E05	488 interface.

DAGE BT22 E06	6 Calibration Weights, 10-500 gram
DAGE BT22 E07	Combination Calibration Weights, 5-10 Kg
DAGE BT22 E08	Calibration Weights 5-20 Kg
DAGE BT22 GUARD	Safety shield used during Die Shear
DAGE BT22 MS1	B&L Stereozoom 0.7-30X mag with 10X Eyepcs & supp 0.5X OBJ with customised E arm
DAGE BT22 MS5	2 Bausch & Lomb X20 wide eye pieces
DAGE BT22 MS7	B&L Stereozoom 10-70X mag with 10X eyepieces & modfd. E arm
DAGE BT22 TABXY	X-Y table for Tab Test.
DAGE BT22 TBCAL	5 Calibration Weights for Tab load cartridge
DAGE BT22 TBHLD	Film clamp for Tab Test. Customer to supply drawings & samples
DAGE BT22 TLC10	Load cartridge for Tab Test 0-100 gr.
DAGE BT22 TLC20	" " " " " 0-200 gr.
DAGE BT22 TLT02	Load tool 0.002" dia.
DAGE BT22 TLT03	Tab load tool 0.003" dia.
DAGE BT22 TLT04	Load tool 0.004" dia.

DAGE BT22 TLT05	Load tool 0.005" dia. for Tab Bond.
DAGE BT22 TLT06	Load tool 0.006" dia.
DAGE BT22 TLTX	Load tool - to customer spec.
DAGE BT22 WS22	Antistatic workstation comprising bench mat, wrist strap, link & ground connections

11.6. IEEE 488 INTERFACE OPTION

CONTENTS

1. Introduction
2. Installation of IEEE kit
3. IEEE 488 Interface Description
   (1) Commands
   (2) Command Format
   (3) Delimitors
   (4) Setting the BT22 Address
4. Electrical Description - PC316 (IEEE)
5. Drawings:

Retrofit Cable Instructions IEEE 488	A3-18291
IEEE 488 Address and Delimitor Switches	A4-18290
PC316 Circuit Diagram	A1-16117
PC316 Component Layout	A2-16118

6. Software Requirement

1. INTRODUCTION

If the BT-22 is supplied with the IEEE 488 option (the connector will be present on the rear service panel) then the installation instructions can be ignored and proceed to Section 11.6.3.

The kit supplied enables a standard BT-22 to be converted for use with the IEEE 488 bus. This enables the front panel control settings to be read and set by the IEEE Bus Controller. The results of tests performed on the BT22 can also be sent via the bus as they occur. The contents of the kit should be confirmed with the following list before proceeding:-

COMPONENT OR PART	QTY	CHK
PC316 Assembly	1	
Motherboard to rear panel cable and connectors	1	
IEEE Socket Retaining screw	2	
M4 Nut	2	
M4 Washer	2	

2. INSTALLATION OF IEEE KIT

Read the instructions before attempting to install the kit. Switch the BT-22 off and isolate from the mains supply.

1. Remove the covers, including the rear panel.
2. Insert PC316 into the empty socket, between PC320 (Master Processor) and PC322 (Power Supply).
   A polarising slot prevents the board from incorrect alignment. The components should face the rear of the machine.

3. Identify the position of socket SKT5, IEEE on the motherboard (PC321).
4. Carefully insert the D.I.L. 24 pin plug through the IEEE socket hole on the rear service panel.
5. Secure the IEEE connector to the rear service panel with the plug retaining screw provided. These jack screws have an internal thread of 3.5 mm with a 0.6 mm pitch to secure a mating IEEE connector.
6. Positioning the cable as shown in drawing A3-18291 insert the D.I.L. plug into socket 5 on the motherboard. Pin 1 is identified by the red wire and the plug should be inserted correctly.
7. Select the required IEEE bus address for the BT-22 and the delimitor required to signify the end of a message. (See Section 11.3.3.3)
8. Replace machine covers.
9. Without connecting the BT-22 to an IEEE bus controller switch it on.
10. Check that the BT-22 functions as it did prior to fitting PC316. When the BT-22 is used by itself there should be no change in its operation.
11. If the BT-22 is not working check that the printed circuit boards and internal wiring have not been disturbed. Check the IEEE interface board (PC316) and cable.

3. IEEE 488 INTERFACE DESCRIPTION

The BT-22 IEEE software enables it to communicate as an addressed listener/talker via the IEEE 488 bus. The information transferred is always in standard A.S.C.I.I. format. This enables the front panel control settings to be read and set by the IEEE controller. The results of tests performed can also be sent via the bus as they occur.

3.1. COMMANDS

These fall into three groups:

(i) Query

The controlling device on the bus can request the BT-22 to return front panel control settings, or if in Remote Mode, those previously sent via the bus.

(ii) Set

This group sets the mode and operating parameters of the BT-22.

(iii) Machine Commands

These commands enable the BT-22 test results to be sent to the controller.

3.2. COMMAND FORMAT

The eight commands consist of two alphabetic characters terminated by a valid delimitor (See Section 3.3.).

3.2.1. Query Settings (Command QS)

On receiving this command the BT-22 returns a variable length string followed by a delimitor (Section 3.3.). The length of the string will depend on the maximum load of the head being used, i.e. 20 grm - 5 characters; 50 Kgm - 18 characters. (It must be remembered that when in Remote Mode, and data has been sent, this and not the control settings will be returned.)

(i) Digit 1

0 - Local

1 - Remote

(ii) Digit 2

0 - Non Destruct Test

1 - Destruct Test

(iii) Digit 3

0 - Step Back

1 - No Step Back

(iv) Digit 4

0 - No Stitch Test

1 - Stitch Test

(v) Digits 5 & 6

This is the digital value of the Load Rate used by the BT-22 from the front panel control, or as set

by the controller via the bus. The range of the control is 00 to 96 and always consists of two digits.

(vi) Digits 7, 8 & 9

The BT-22 returns the digital value of the Hold Delay in the range 000 to 255. This is the delay once the non destruct load has been reached before the end of a test, it is normally set to 005.

(vii) Digits 10, 11 & 12

This is the non destruct load setting as indicated by the front panel thumbwheel switches unless the BT-22 is in the Remote Mode. This will always be a three digit number in the range 000 to 999. A decimal point is not sent but can be inserted using knowledge of the maximum head load.

i.e. 20 grm head - 141 returned.
maximum load 14.1 gm

OR 10 Kg head - 631 returned.
maximum load 6.31 Kg

(viii) Digit 13

This is the type of load cartridge being used.

0 - Low Deflection Cartridge

1 - Normal

(ix) Digits, 14, (15, 16, 17, & 18)

This is the maximum load that can be used with the head fitted. The returned value is in grammes, i.e.

20 is a 20 gm head

20000 is a 20Kg head

The various types of head, i.e. shear are not differentiated.

Example return strings:-

a. 0 1 1 0 9 6 0 0 5 0 2 0 1 2 0

b. 1 0 0 1 5 0 0 0 5 1 1 1 0 2 0 0

(a) 0 - Local

1 - Destruct Test

1 - No Step Back

0 - No Stitch Test

96 - Load rate of 96

005 - Hold delay

020 - Non destruct load of 2.0 gm

1 - Normal cartridge

20 - 20 gm head fitted

(b) 1 - Remote

0 - Non destruct Test

0 - Step Back

1 - Stitch Test

50 - Load rate

005 - Hold Delay

111 - Non destruct load of 111 gm

0 - Low Deflection Cartridge

200 - 200 gm head fitted

3.2.2. Set Local Mode (Command SL)

In this mode the Step Back, Stitch Test, Non-Destruct/Destruct Test, Load Rate and Non-Destruct Load are all set from the front panel controls. The Set Machine (SM) command and Reset Test Results (ST) are ignored in this mode. The BT-22 automatically assumes Local Mode when first turned on.

No data is required with this command, and no data is returned.

3.2.3. Set Remote Mode (Command SR)

This mode enables Reset Test Results and the Set Machine commands to be used as well as those available in the local mode. Front panel controls will still be used by the BT-22 until data has been received via the bus with the Set Machine (SM) command.

If the BT-22 now receives a Set Local command, then the front panel controls will again be used and the control settings sent via the bus will be lost.

3.2.4. Set Machine (Command SM)

This command will be ignored if the BT-22 is in local mode. If in remote mode the BT-22 expects a 16 character string which includes

five ',' to separate the data, followed by a delimitor. The data has to be sent in the correct format and order.

i) Character 1

0 - Non Destruct Test

1 - Destruct Test

ii) Character 2

This is a ',' to separate data.

iii) Character 3

0 - Step Back

1 - No Step Back

iv) Character 4

This is a ',' to separate the data.

v) Character 5

0 - No Stitch Test

1 - Stitch Test

vi) Character 6

This is a ',' to separate the data.

vii) Characters 7 & 8

This is a digital value of the Load Rate and can be set in the range 00 to 96. It should always be a two digit integer number, i.e. for 1 send 01.

viii) Character 9

This is a ',' to separate the data.

ix) Characters 10, 11 & 12

These set the Hold Delay in the range 000 to 255 and is normally set to 005. A three digit integer is always required.

x) Character 13

This is a ',' to separate the data.

xi) Characters 14, 15 & 16

These set the Non Destruct Load value in the range 000 to 999 with an implied decimal point dependent on the maximum load of the heading being used, i.e.

if 010 is sent with a 20 gm head this gives a non destruct load of 1.0 gm.

The data sent should not include a decimal point but always consist of three digits.

3.2.5. Reset Test Results (Command ST)

This command will be ignored if the BT-22 is in load mode. If in remote mode the stored test results will be deleted. (Not dependent on Printer status).

Normally when the printer is turned off the test data is deleted and if the printer is not on, the test results are not stored. However, if test results are being sent to the controller the data is stored irrespective of the printer status. Turning the printer on or off will have no effect on the data storage until the BT-22 is required to stop sending results, at which point normal printer control is resumed.

3.2.6. Send all Test Results (Command MA) This command sets the BT-22 to return the results of all tests succeeding the command as they occur. The result of a successful non-destruct test is sent immediately while the result of a destruct test will not be sent until a fail code has been pressed. The BT-22 will not start another test until a code has been pressed. The printer can still be used to give the operator a visiable copy of the tests performed while this command is operational.

If a failure is regraded or a pass becomes a fail then pressing a fail code will cause the result data to be sent again, with the new code, similarly for an erased test. (The test number remains the same). A test can be regraded until the Start Test button is pressed. A new test causes the test number to be incremented. The results sent via the bus are similar to the data output by the printer. The first digit(s) is the test number followed by a comma. The next information is the maximum load in grammes, reached during the test including a decimal point if necessary. The last set of data in the string, preceded by a comma, is either 'OK' for successful non-destruct test, and

'F' followed by the fail code, ER for an erased test or OH for overheight, plus a delimitor, i.e.

Test No.	Load (grammes)	Pass or Fail
1	13.2	OK
2	13.0	F1
2	13.0	F2
3	13.2	OK
3	13.2	F1
3	13.2	ER
3	13.0	OH

No data is required with this command.

3.2.7. Cancel Sending Test Results (Command MC)

This command should be used in conjunction with the Send All Test Results (Command MA). The BT-22 continues to send test results, if requested, until it receives this command.

If the BT-22 is sending all test results then it will wait until data has been accepted by the controller before allowing another test. If the controller will not accept further data then the BT-22 will appear to stop. Therefore, if test results are no longer required via the bus then the 'MC' command must be sent.

No data is required with this command.

3.2.8. Machine Test Results (Command MR)

This command returns information identical to the Send All Results Command (MA) except that only one result is sent. There is no need to cancel this command as this is automatically cleared after one result has been sent via the bus. The main use of this command is for initial setting up of the IEEE 488 bus, as it does not allow regrading of results. No data is required with this command.

3.2.9. Returning BT-22 Results to the Controller

Sending either Send All Results (MA) or Machine Test Results (MR) to the BT-22 causes the BT-22 to output a Service Request to the controller when a new test result is available, or a re-grade is performed. The controller upon receiving this request should then Serial Pool each device on the bus. When the BT-22 is addressed it will reply by sending its status byte. If it was the device requesting the service then the status byte will have bits 7 and 8 set. Bit 7 set is the IEEE standard for detecting the source of the Service Request, however bit 8 is also set by the BT-22 for further identification. Both bits 7 and 8 are cleared when the request is serviced. The

BT-22, once enabled by the controller, sends the test results over the bus. The controller should then continue in its normal operation until a further Service Request is received.

With the Machine Test Results (MR) command the BT-22 does not generate any further Service Requests after one result has been sent.

The Cancel Sending Test Results (MC) command cancels either the 'MA' or 'MR' commands and hence prevents the BT-22 from producing a Service Request when a test is available.

NOTE: There will be a delay in the response of the BT-22 to an IEEE command if it is busy, i.e. the response to Query Settings command will be delayed if the load cartridge is being moved when the command is received. Similarly care should be exercised when sending command (MC) as the BT-22 may be performing a test, and then try and return the results before interpreting the results. If the controller is not expecting any further results then obviously a bus conflict can occur.

3.3. DELIMITORS

One of the problems associated with the IEEE standard 488-1975 is that no definition is given to data formats. Although most machines, especially processor based units, communicate using standard ASCII characters, there is still a problem in one computer telling another that it has finished data transmission. The character, characters or signal which indicates this and also separate strings or number digits (i.e. end of complete number) are called delimitors.

As it is most likely that the control system will be a desk-top computer using BASIC as an operating language, the BT-22 uses CR (carriage return) LF (line feed) as a delimitor.

However, a number of options are available as some systems do not output line feed, and others do not wait for it to be transmitted before processing the data, hence latching up the bus.

In addition there is a signal EOI (end or identify) which exists on the bus which on some machines is set true concurrently with the last byte of a data string and hence signifying the end of that string.

By setting the switches shown, see Drawing A4-18290, it is possible to set the BT-22 to respond to and send a delimator of:-

Receive

i) EOI on last character of data or command string.

ii) Carriage return (with or without EOI)

iii) Line feed (with or without EOI)

iv) Carriage return, line feed (with or without EOI)

Send

i) EOI concurrently with a 'space' character.

ii) EOI concurrently with a carriage return.

iii) EOI concurrently with a line feed.

iv) Carriage return followed by line feed with concurrent EOI signal.

3.4 SETTING THE BT-22 ADDRESS

The talker/listener address is set using PCB mounted switches on PC316 and are used to set a unique address for the BT-22 on multi-equipment systems.

For switch settings see Drawing A4-18290.

NOTE: Switch the machine off before changing the Address or Delimitor settings.

4. ELECTRICAL DESCRIPTION - PC316 (IEEE)

This printed circuit board is a general interface which has functions other than providing an IEEE interface, therefore some components may not be fitted.

The PC316 has its own +5V regulator, IC1, which is supplied with rectified and smoothed +8V from the Power Supply card.

The IEEE bus interface is implemented by IC13, MC68488, which automatically handles all handshake protocol needed for the bus.

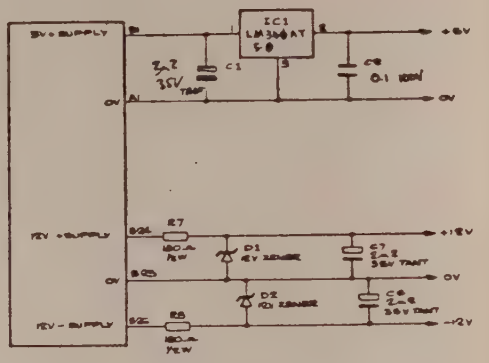
Four 'Quad Interface Bus Transceivers' IC17, 18, 19, & 20, are used to meet the electrical specification of the IEEE 488 bus.

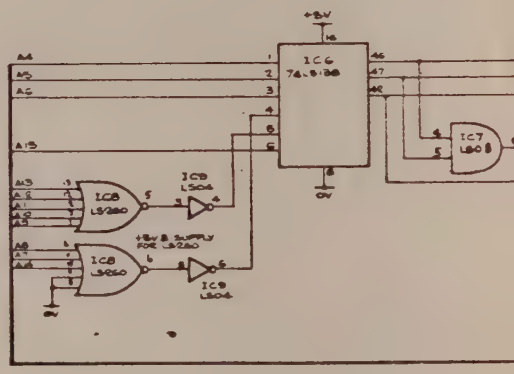
The data transferred via the IEEE bus is controlled by the microprocessor on PC320. The processor address lines are decoded by IC6, 7, 8, and 9, while IC21 buffers the data bus.

The IEEE bus address and delimitors are set by SW1, while IC10 allows these switches to be read by the processor on the data bus.

3rd ANGLE PROJ.

	A	B
1	0V	+5V SUPPLY
2	A9	A5
3	A8	A4
4	A7	A3
5	A6	A2
6	DIO1	A1
7	DIO2	A0
8	DIO3	SRQ
9	DIO4	EOI
10	DIO5	ATN
11	DIO6	GPIB GROUND
12	DIO7	
13	DIO8	FILE PROTECT
14	DAV	CASSETTE PRESENCE
15	NDAC	BD GOT
16	NRFD	TAPE R/$\overline{W}$
17	IFC	FWD
18	REN	REW
19	SEARCH	PAST
20	LEVEL CHECK	A15
21	READ DATA	A14
22	WRITE DATA	A13
23	READ CLOCK	
24	READ DATA	+12V SUPPLY
25		0V
26	CTS	-12V SUPPLY
27	DSR	A12
28	RTS	
29	DTR	PA1
30	DATA IN (R×D)	PA0
31	DATA OUT (T×D)	R/$\overline{W}$
32	SHS GND	D0
33	RLSD	D1
34	PROTECTIVE GND	D2
35	CAI	D3
36	PA4	D4
37		
38	$\overline{IEO}$	D5
39		D6
40	$\overline{RESET}$	D7
41	Ø2	CAR
42	PA3	A11
43	PA2	A10

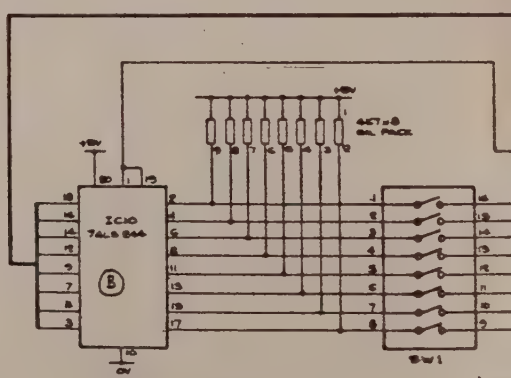




COMPONENT	NO OFF	NO OF PINS	@V	+5V	-12V	+12V
7404	1	14	7	14		
74LS04	2	14	7	14		
7406	1	14	7	14		
74LS-38	1	16	8	16		
74132	1	14	7	14		
74LS244	1	20	10	20		
74LS245	1	20	10	20		
MC 6850	1	24	1	12		
MC 44-1	1	24	12	24		
MC 14488	1	40	1	20		
3448	4	16	8	16		
6822	1	40	1	20		
75-50	1	8	4	1	5	8
75154	1	16	8	8, 16		
74LS260	1	14	7	14		
74LS32	1	14	7	14		

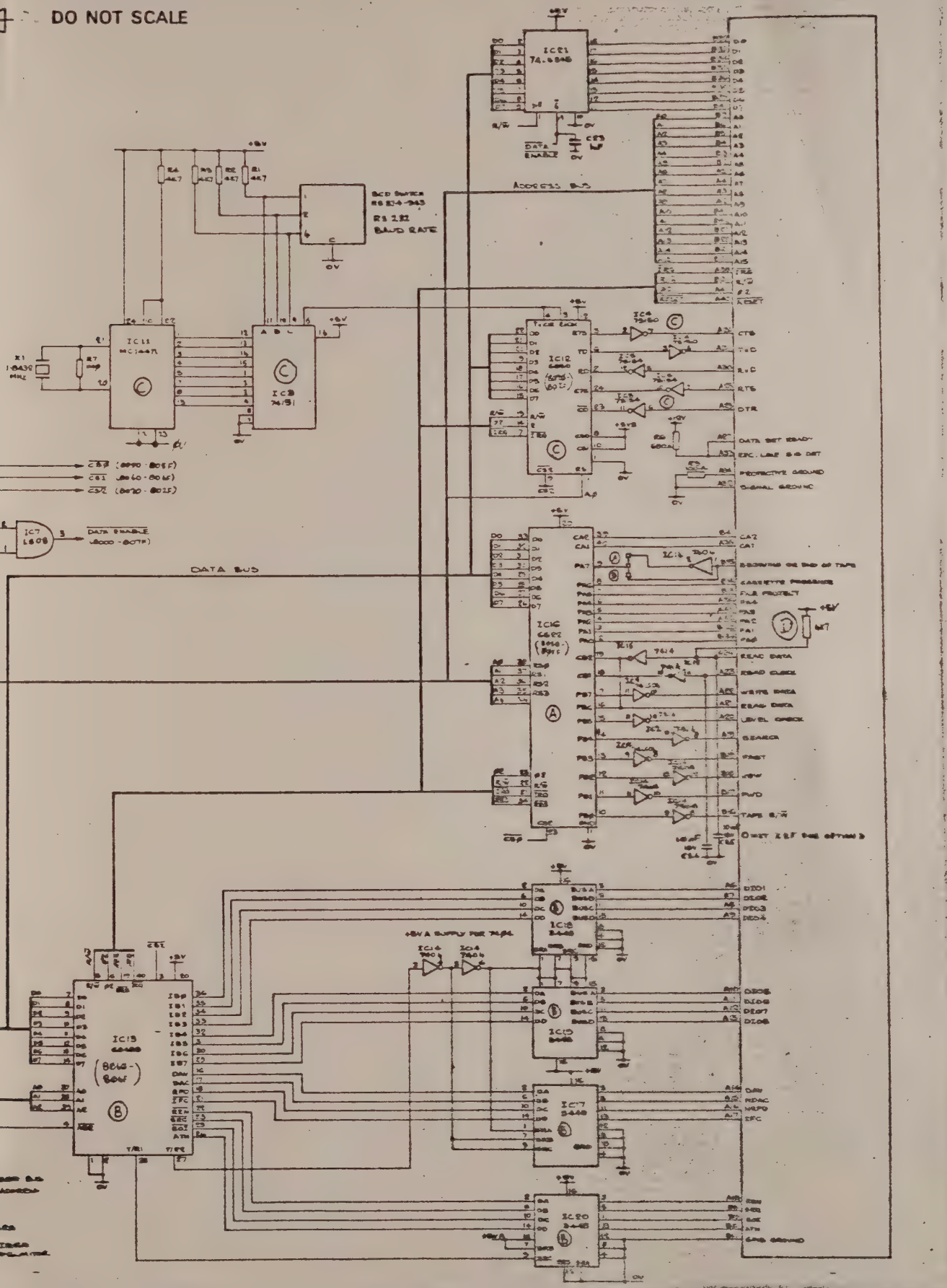
NOTES

ALL RESISTORS 1/4W UNLESS STATED OTHERWISE



ISSUE 2	ISSUE 3	ISSUE C	ISSUE 5	ISSUE 6
PCB 6		HNE 1004		
		3-7-85		

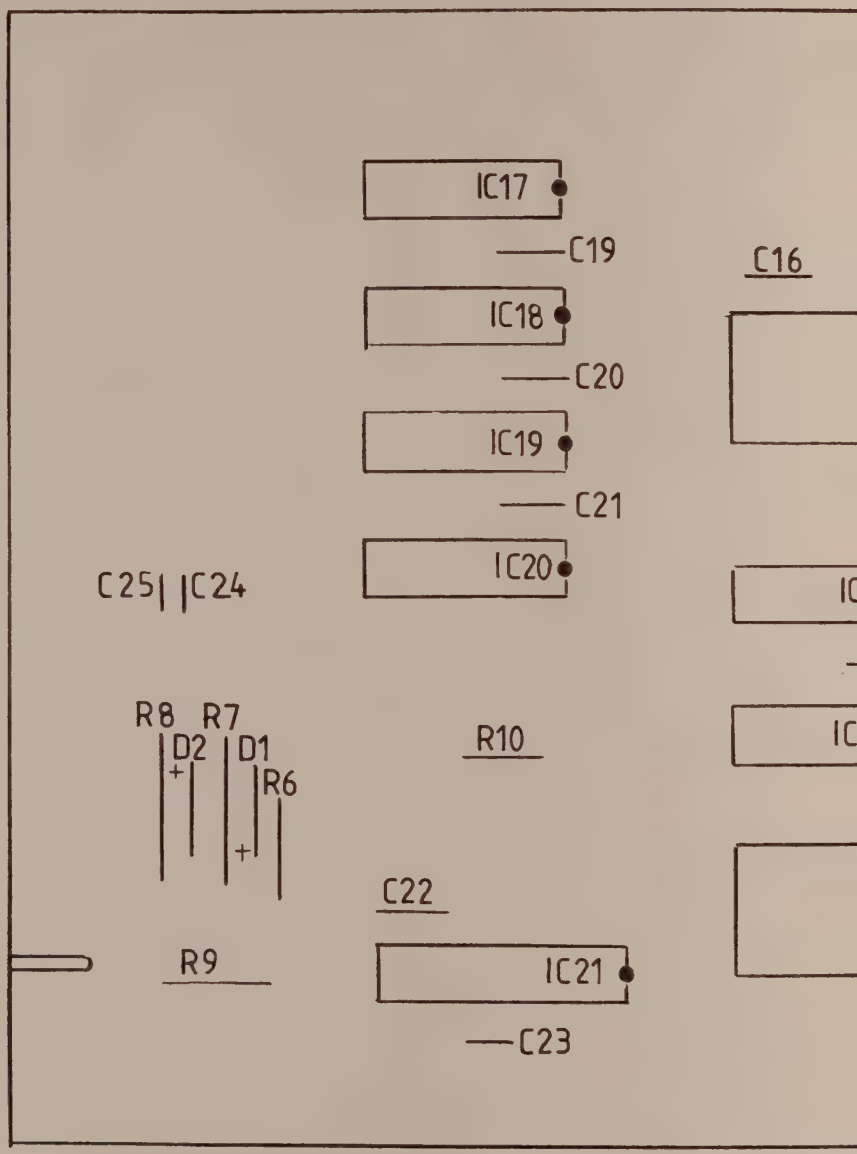
DO NOT SCALE



	TOL FRAC ±1/64" DEC ±.005"	MATL	FINISH		
	DRAWN / No OFF	PART COMMUNICATIONS INTERFACE PC 3161	USED ON PROG' XY TABLE	DRG NO A1– 1617/ Version 2	
				DATE	

PROJECTION | IF IN DOUBT ASK

REF	VALUE OR TYPE
R1	4K7
R2	4K7
R3	4K7
R4	4K7
R5	1MØ
R6	68ØR
R7	18ØR ½W
R8	18ØR ½W
R9	1ØØR
R10	4K7 *
RN1	4K7×8 SIL
C6-7	2µ2 35V
C8-22	Øµ1 5ØV
C23	1nØ
C24-25	1Øn
C1	2µ2 35V TANT
D1-2	12V ZENER
C2	Øµ1 5ØV
IC1	LM340 AT 5·Ø
IC2	7416
IC3	74151
IC4	7515Ø
IC5	75154
IC6	74LS138
IC7	74LSØ8
IC8	74LS26Ø
IC9	74Ø4
IC1Ø	74LS244
IC11	MC14411
IC12	685Ø
IC13	68488
IC14	74Ø4
IC15	7414
IC16	6522
IC17	3448
IC18	3448
IC19	3448
IC20	3448
IC21	74LS245
SW1-8	145-432 (FARNELL)
SW9	334-945
X1	1,8432MHz



* OPTION D R10 FITTED, & LINK 'D' MADE
OTHER OPTIONS LINK A & OMIT R10

THIS DRAWING IS THE PROPERTY OF DAGE AND MUST NOT BE USED OR REPRODUCED WITHOUT WRITTEN CONSENT

MATERIAL: –

FINISH: –

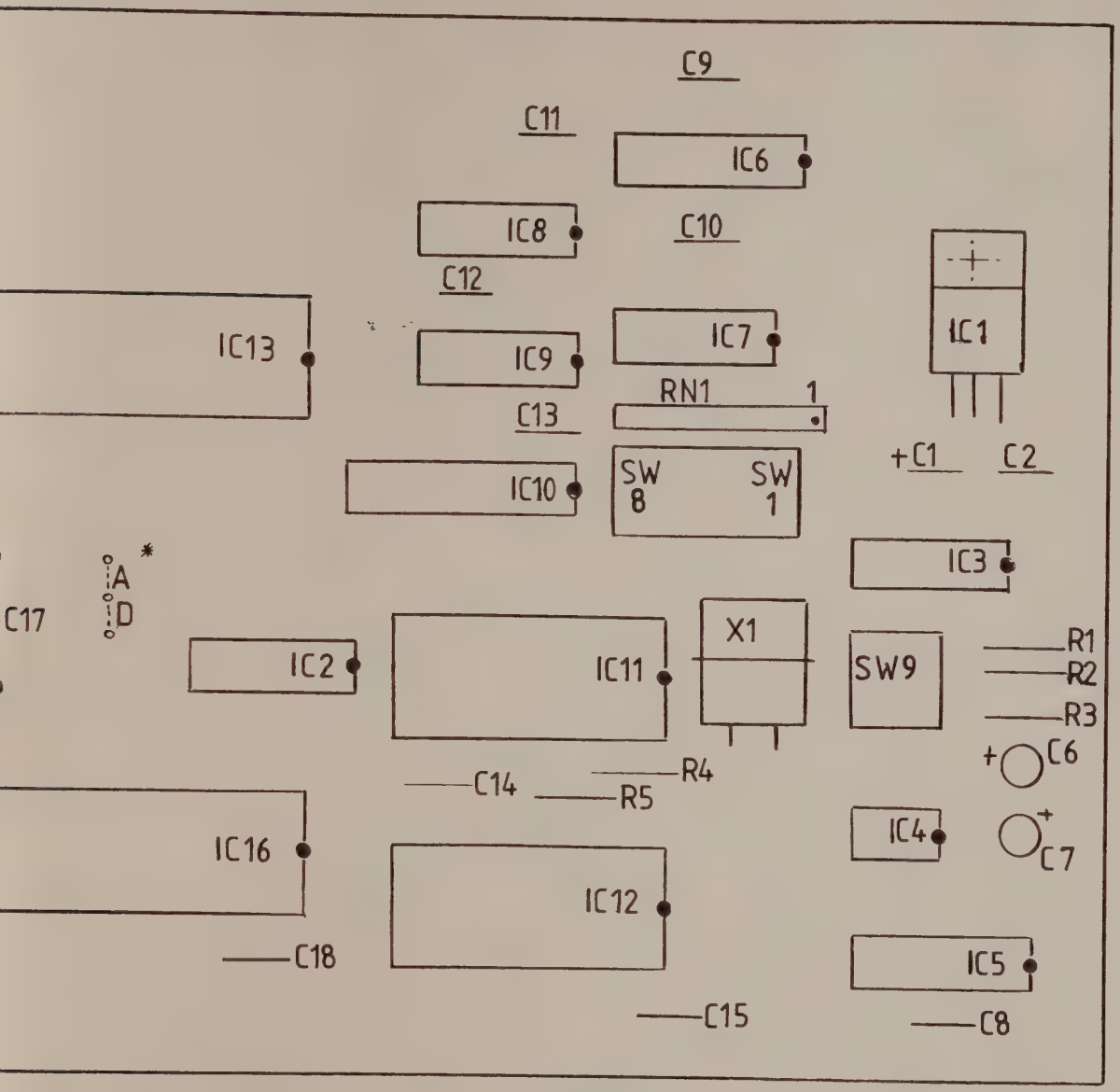
NOTES: –

FOR EXPLANATION OF DIMENSIONS, TOLERANCES, NOTES, ETC., SEE BS 308.

ISSUE	MODIFICATION	DATE
	ORIGINAL	

BTS61485/359

REMOVE ALL BURRS AND SHARP EDGES	DO NOT SCALE



A.J.B	DATE 1/3/88	Dage Applied Technology Division Rabans Lane, Aylesbury, Bucks. HP19 3RG. Telephone (0296) 33200 Telex 83518	TITLE COMPONENT LAYOUT FOR PC-316
	DES.		
TOL. ±	ANGLES ± 0° 30'		
IN	SCALE		DRAWING No. A2-16118
S ⊕	GEN. 1·6		SHEET OF

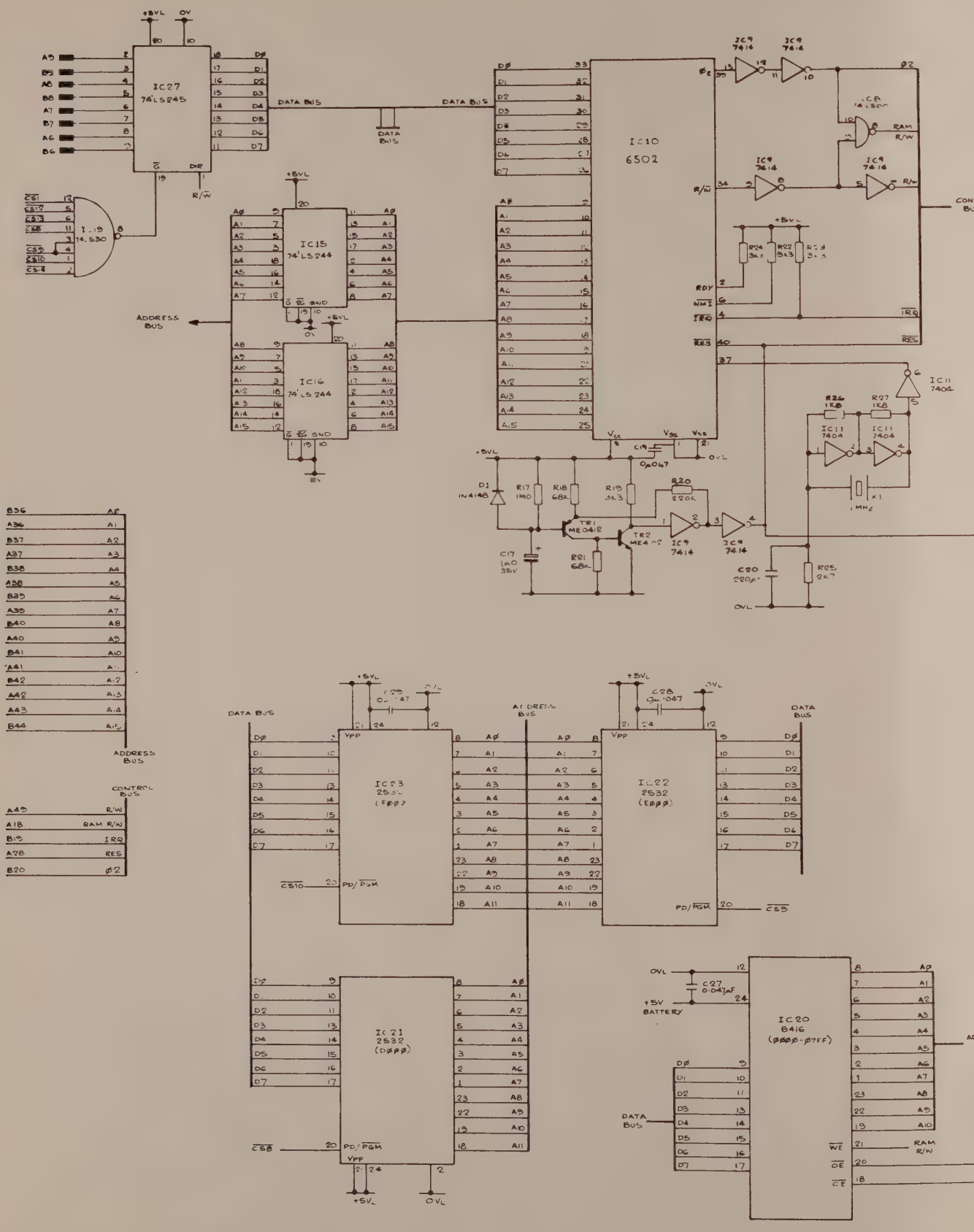
BT22 SPARES LIST

PART NO	DESCRIPTION
Dage SE CPRV13	Control Paddle Assy Potentiometer
Dage SE CPRV14	10k Pot. (Load Rate)
Dage SE CPRV16	Servo Potentiometer 10k (vert. carriage position
Dage SE FU0001	Fuse 1A 20mm pack of 5 for 220/240 V machines with Serial Nos before 6609
Dage SE FU0003	Fuse 3A 20mm (Power Supply) pack of 5
Dage SE FU0005	Fuse for 100/110 V AC supply 1.25 amp for machines with Serial Nos after 6609 (pack of 5)
Dage SE FU0006	Fuse for 220/240 V AC supply 630 Mamp for machines with Serial Nos after 6609 (pack of 5)
Dage SE FU0012	Fuse 2A 1.1/2" pack of 5 for 100/110 V machines with Serial Nos before 6609
Dage SE Head	Ceramic Print Head
Dage SE KIT22	Standard spares kit (240v)
Dage SE KIT22U	Standard spares kit (110v)
Dage SE LP0010	Flood lamp bulb GE1383 (for Serial Nos prior to 06434)
Dage SE LP0020	Flood lamp bulb (for Seial Nos after 06434)
Dage SE M00017	Motor (vert. carriage drive)
Dage SE MS0103	Thermal printer and controller
Dage SE MS0104	Liquid crystal display for machines with Serial Nos before 6625
Dage SE MS0105	Liquid crystal display for machines with Serial Nops after 6625
Dage SE PC181	Assy Motor speed controller pcb for new type LC40
Dage SE PC182	LC direction switch pcb for use on LC40 range
Dage SE PC288	Keyboard pcb assy
Dage SE PC291	Thumbwheel pcb
Dage SE PC296	Sensor pcb
Dage SE PC320	Logic pcb
Dage SE PC321	Mother board
Dage SE PC322	Power supply board
Dage SE PC328	Lower switch assy
Dage SE PC329	Upper switch assy
Dage SE PC350	LCD display pcb for machines with Serial Nos before 6625
Dage SE PC405	Liquid crystal display pcb for machines with Serial Nos after 6625
Dage SE PG0001	Override kit to eliminate .003" movement before start of test (Verison 1.4 software)
Dage SE PG0002	Set of 3 Eproms with standard Version 1.4A software
Dage SE PL0022	Load cartridge plug for BT22
Dage SE PL0023	Socket 12 pin (for load cartridge connection)
Dage SE SW0020	Microswitch (start test button)
Dage SE SW0028	Microswitch rollar act. (vert carriage limit)

13. BT-22 LIST OF DRAWINGS

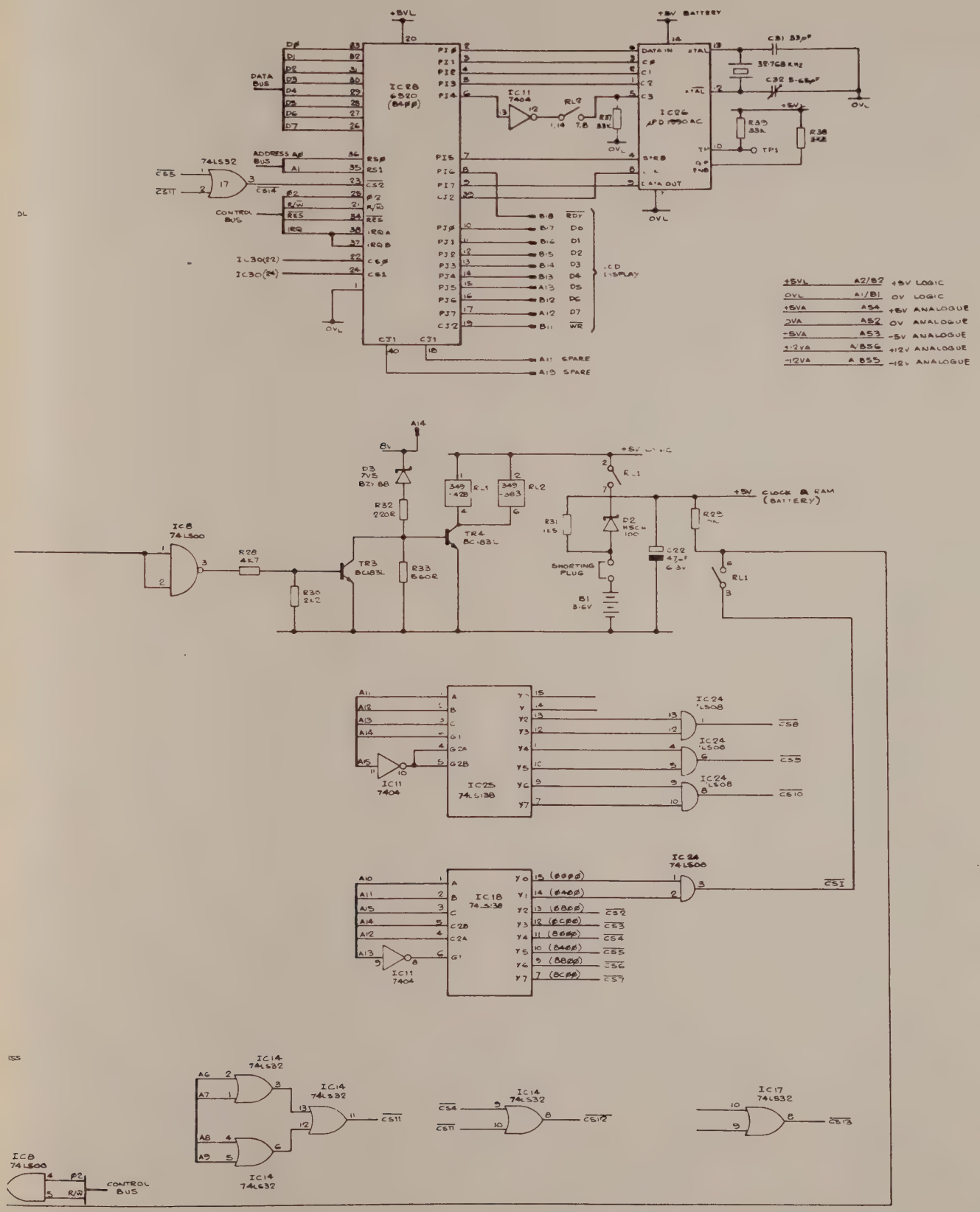
PC320	Main Microprocessor & Logic Control	A1-17845
	Circuit Diagram	A1-17846
	Component Layout	A1-16559
PC321	Motherboard & Interconnections	
	PC406 LCD & Connector to Motherboard	A4-700192
	PC320 Power Supply Connector to Motherboard	A3-18023
	Transformer, Printer & Motor conn. to Motherboard	A3-18024
	Fail Code Keyboard Thumbwheel Head Socket	A3-18025
	Analogue Inputs, Motor Speed Control and Front Panel Switches	A3-18026
	PC316 (IEEE - RS232-XY-TABLE) conn. to Motherboard	A3-18027
PC322	Power Supply & Motor Speed Control	
	Circuit Diagram	A2-17844
	Component Layout	A1-16561
PC328	Lower Switch Assy - Component Layout	A3-16296
PC329	Upper Switch Assy - Component Layout	A3-16297
	Main M/C Wiring (Excluding Motherboard)	A3-18028
	Motherboard Wiring to Machine	A3-18029
	Load Cartridge Connections	A3-18030
PC406	LCD Interconection Component Layout	A3-700193
	Printer Paper Loading System	A4-14245
	WH5 Torque Shear Jig - Positional Data	A2-16400
	Instructions for WH5 Torque Shear Jig	A4-16401

3rd ANGLE PROJ.



ISSUE 2	ISSUE 3	ISSUE 4	ISSUE E	ISSUE F
	ALL REF TO IC9 WAS 74LS14	MNE 1.04 10-7-85		

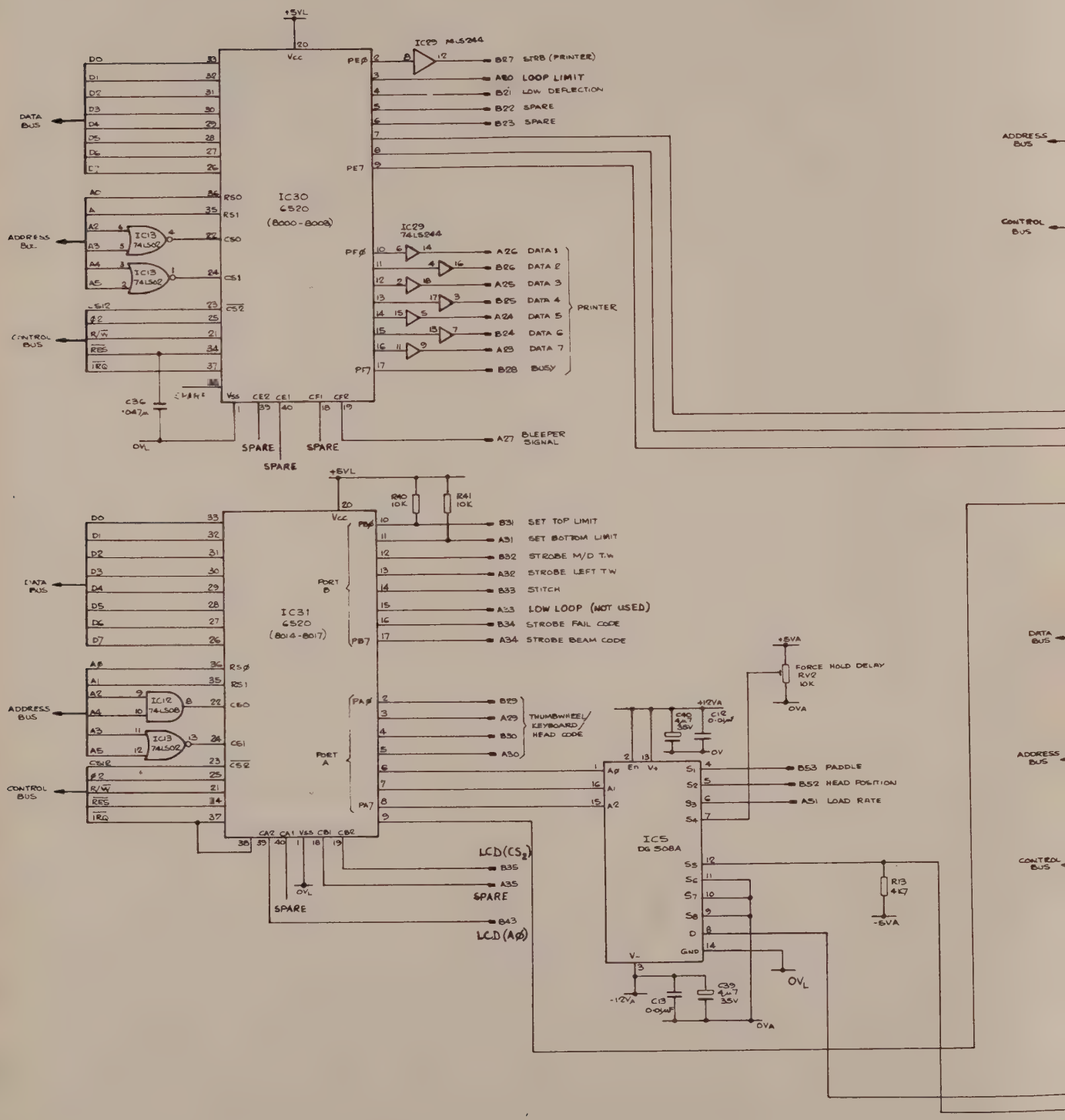
DO NOT SCALE



NOTE SEE ALSO DRG No A1-17846

ISSUE 7	TOL. FRAC ± 1/64" DEC ± ·005"	MATL.	FINISH	Applied Technology Division	
	DRAWN	No OFF	PART	USED ON	DRG No
			MAIN CIRCUIT DIAGRAM PC 320 μP	MCT 22	A1– 17845

3rd ANGLE PROJ.



ISSUE 2	ISSUE 3	ISSUE D	ISSUE	ISSUE	
	IC 4 (LF347) WAS LM324 R8 10K WAS 5K6 R7 4K7 WAS 2K7				

MCS 16/8/84

DO NOT SCALE

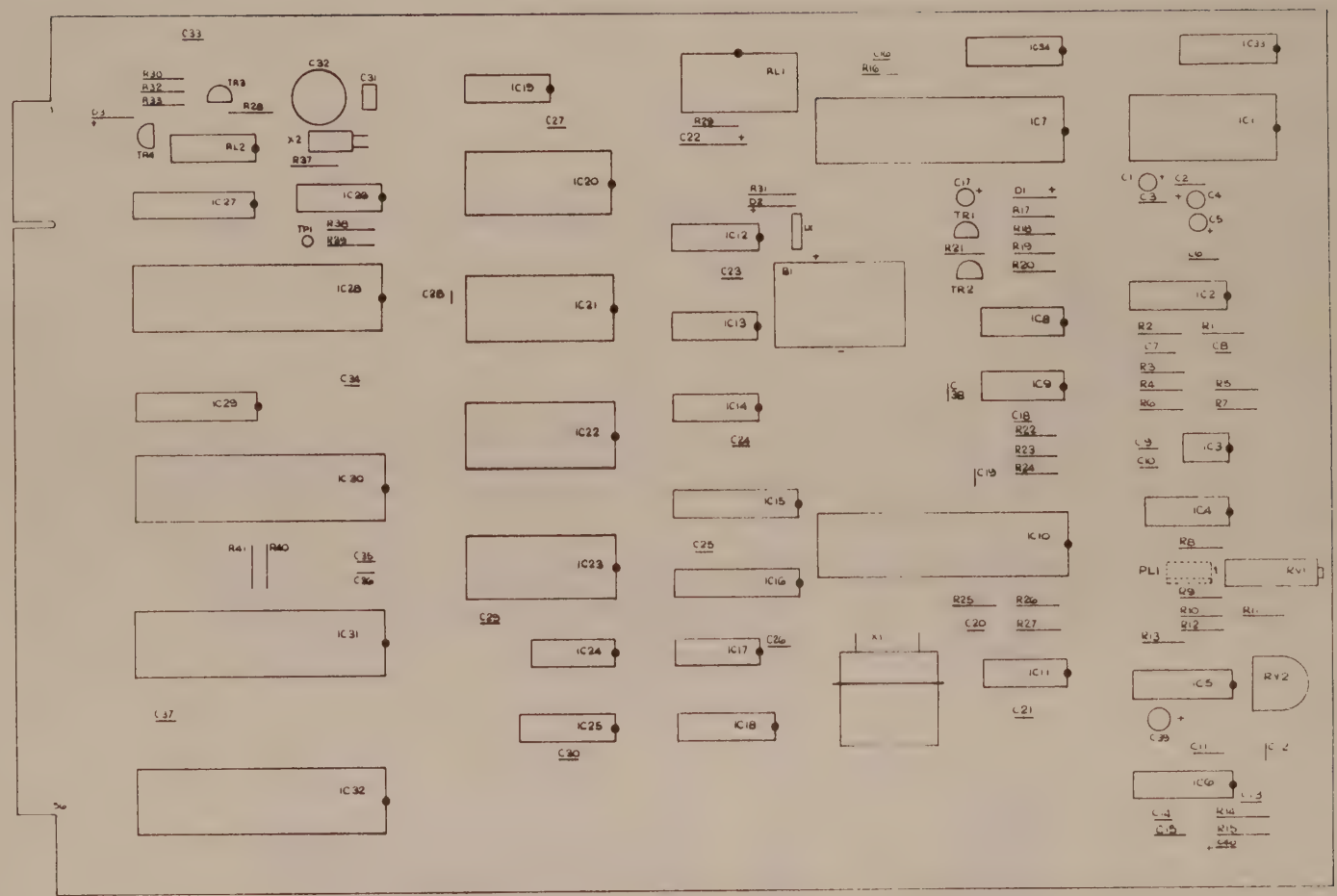
NOTE - SEE ALSO A1-17845

ISSUE	TOL. FRAC ± 1/64 DEC ± .005	MATL	FINISH	Applied Technol
	DRAWN	No OFF	PART	USED ON
			MAIN CIRCUIT DIAGRAM DC 220 D	MCT 22

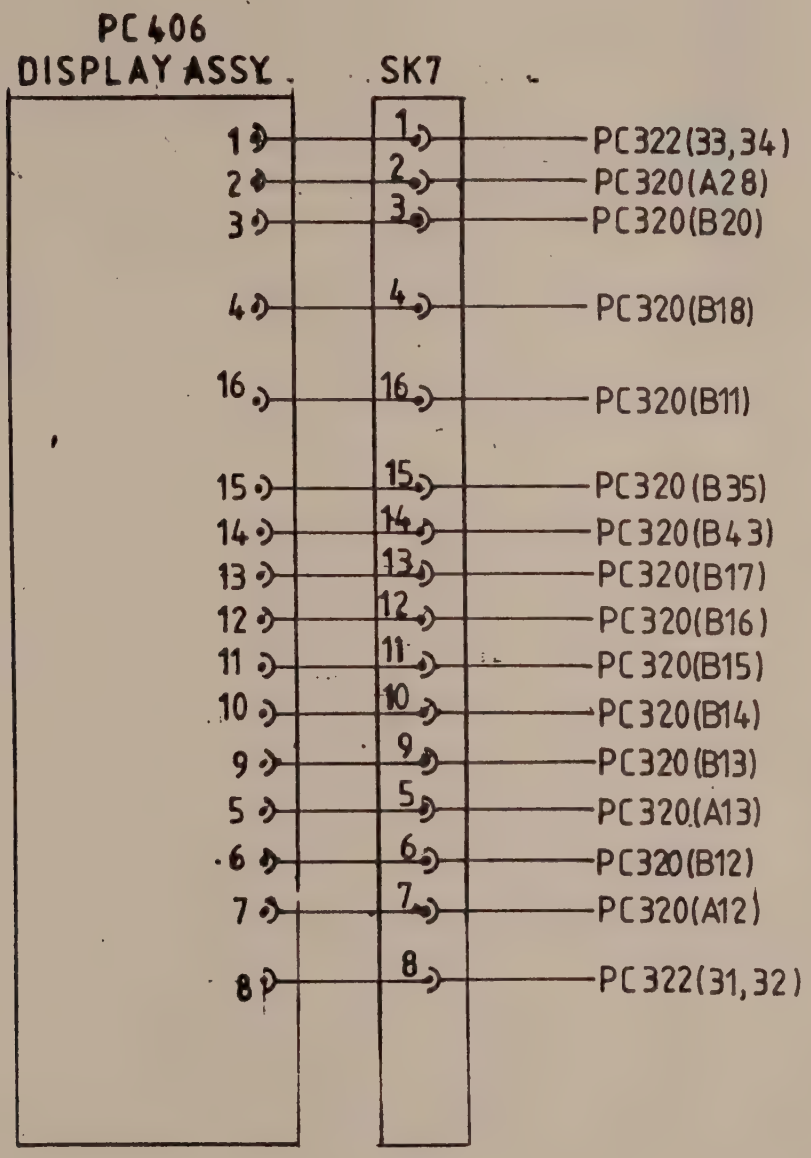
DRG No

REF	VALUE	REF	VALUE	REF	TYPE
R1	22K	C1	4µ7	IC1	ADC 10
R2	22K	C2	0µ1	IC2	DAC 0800
R3	15K	C3	0µ1	IC3	555
R4	15K	C4	4µ7	IC4	LF347
R5	1·1K	C5	10µ	IC5	DG508
R6	47K	C6	0µ1	IC6	DAC0800
R7	4K7	C7	0µ1	IC7	6520
R8	49R9 HB	C8	0µ01	IC8	74LS00
R9	182R HB	C9	0µ0022	IC9	7414
R10	9K76 HB	C10	0µ01	IC10	6502
R11	10K HB	C11	0µ1	IC11	7404
R12	100K HB	C12	0µ01	IC12	74LS08
R13	4K7	C13	0µ01	IC13	74LS02
R14	2K55 HB	C14	0µ01	IC14	74LS32
R15	2K55 HB	C15	0µ1	IC15	74LS244
R16	10K	C16	0µ047	IC16	74LS244
R17	1MO	C17	1µ0	IC17	74LS32
R18	68K	C18	0µ047	IC18	74LS138
R19	3K3	C19	0µ047	IC19	74LS30
R20	220K	C20	220p	IC20	8412
R21	68K	C21	0µ047	IC21	2532
R22	3K3	C22	47µ 6·3V	IC22	2532
R23	3K3	C23	0µ047	IC23	2832
R24	3K9	C24	0µ047	IC24	74LS08
R25	2K7	C25	0µ047	IC25	74LS138
R26	1K8	C26	0µ047	IC26	1990
R27	1K8	C27	0µ047	IC27	74LS245
R28	4K7	C28	0µ047	IC28	6520
R29	10K	C29	0µ047	IC29	74LS244
R30	2K2	C30	0µ047	IC30	6520
R31	1K5	C31	33p	IC31	6520
R32	220R	C32	5-65p	IC32	6520
R33	560R	C33	0µ047	IC33	4050
R34	—	C34	0µ047	IC34	4050
R35	—	C35	0µ047	D1	IN4148
R36	—	C36	0µ047	D2	HSCH1001
R37	33K	C37	0µ047	D3	BZY88 7V5
R38	3K3	C38	0µ047	TR1	ME0412
R39	33K	C39	4µ7 35V	TR2	ME4102
R40	10K	C40	4µ7 35V	TR3	BC183L
R41	10K			TR4	BC183L
				TR5	
		X1	1MHZ	TR6	
		X2	32·768KHz		
RV1	50K	B1	3·6V NiSB3	RL1	349-428
RV2	10K			RL2	349-383

NOTE: DO NOT FIT B1 DURING ASSEMBLY



ISSUE 2	ISSUE 3	ISSUE 4	ISSUE D			TOL.	MATL.	FINISH	Applied Technology Division
REF IC9 TYPE WAS 74LS14	+ 22 +150 B 155 B 23 VALUES ALTERED		MNE 1002 28-A-ME			FRAC ± 1/64" DEC. ± .005"			
						DRAWN dm 20-8-88	No. OFF	PART COMPONENT LAYOUT FOR PC320	USED ON MCT 22	DRG No A1-10559
									DATE



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	ORIGINAL	
ISSUE	MODIFICATION	DATE

DIMS. IN	MATERIAL :–
GEN. TOL. ±	FINISH :–
HOLES ⊕	GEN. 1.6/
ANGLES ± 0° 30'	SCALE
DRN. A. J. B.	DATE 10. 87
CHKD.	DES.

FOR EXPLANATION OF DIMENSIONS, TOLERANCES, NOTES, ETC., SEE BS 308.

Dage Applied Technology Division
Rabans Lane, Aylesbury, Bucks HP19 3RG.
Telephone (0296) 33200 Telex 83518

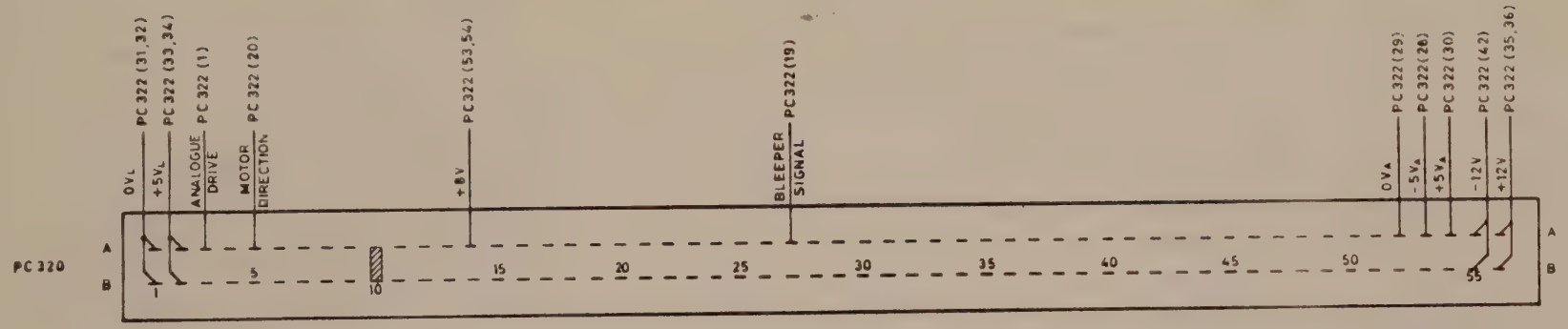
TITLE PC 406
CONNECTIONS TO
MOTHER BOARD

DRAWING No.
A4- 700192

SHEET OF

3rd ANGLE PROJ.

DO NOT SCALE



MNE 1004
5-7-85

ISSUE E
MNE 1007
11-11-85

ISSUE F

ISSUE G

ISSUE H

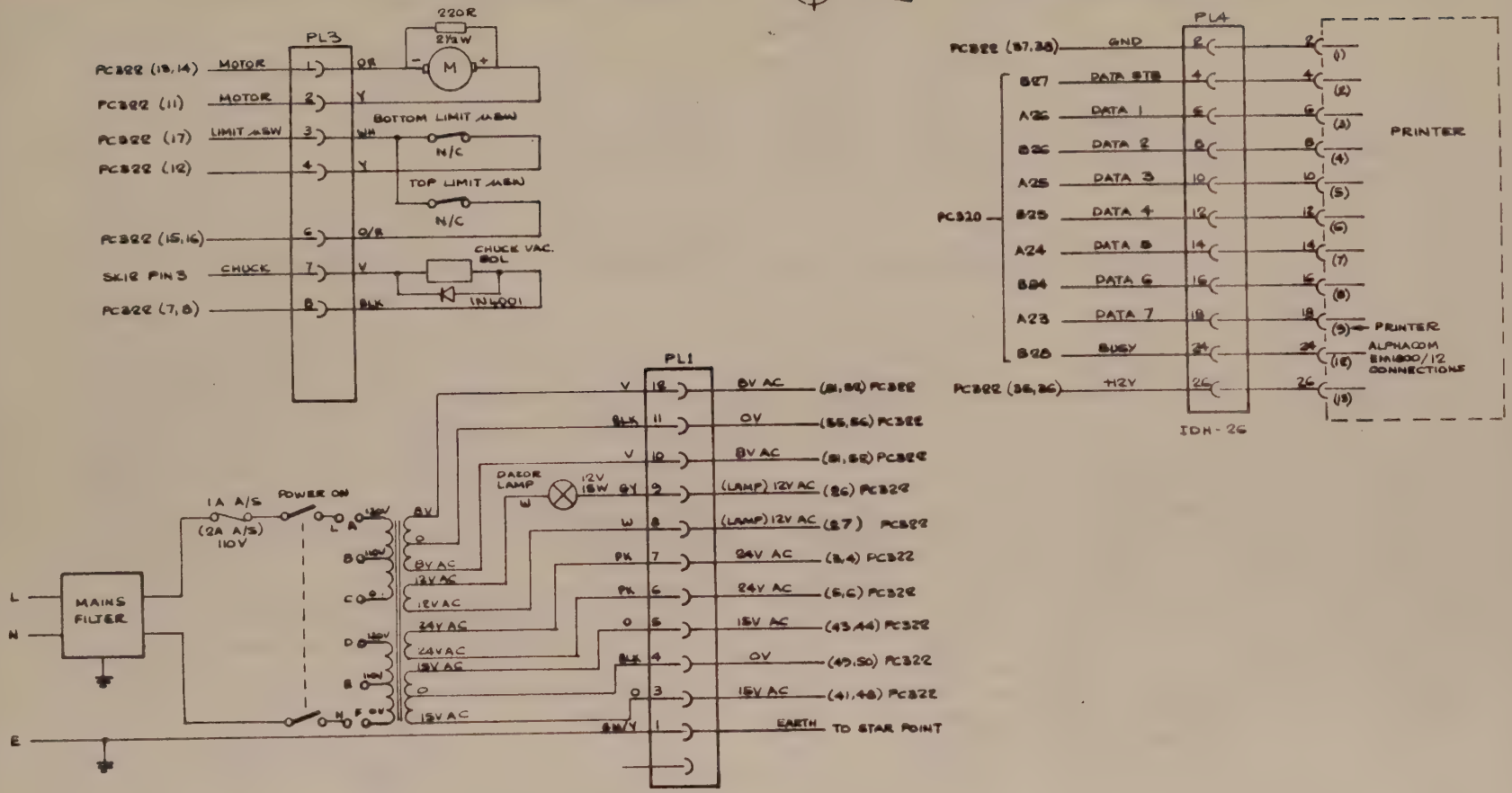
ISSUE J

TOL FRAC ± 1/64" DEC ± .005"	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
DRAWN / No. OFF	PART: PC320 POWER SUPPLY CONNECTIONS	USED ON: MCT 22	DRG No: A3—18023

Date

3rd ANGLE PROJ.

DO NOT SCALE



240V A-L F-N LINK C&D

220V B-L F-N LINK C&E

110V C&F -N B&E-L

ISSUE A

MNE 1004

4-7-85

ISSUE

ISSUE

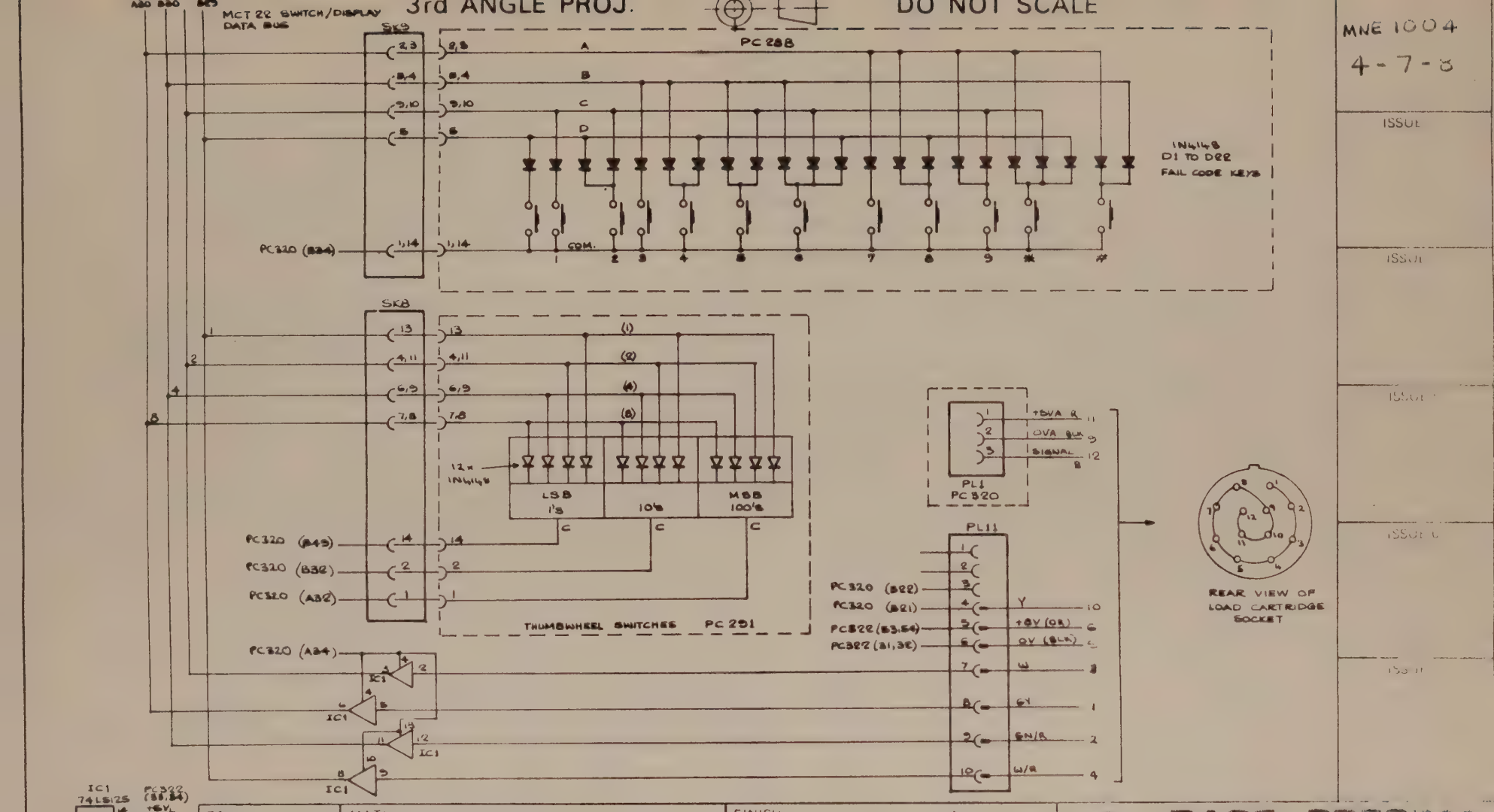
ISSUE 6

ISSUE

TOL	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
FRAC ± 1/64" DEC ± .005"			
DRAWN / No. OFF	PART: TRANSFORMER, PRINTER AND MOTOR CONNECTIONS TO MOTHERBOARD	USED ON: MCT 22	DRG No: A3—18024

DATE

J.W 2312

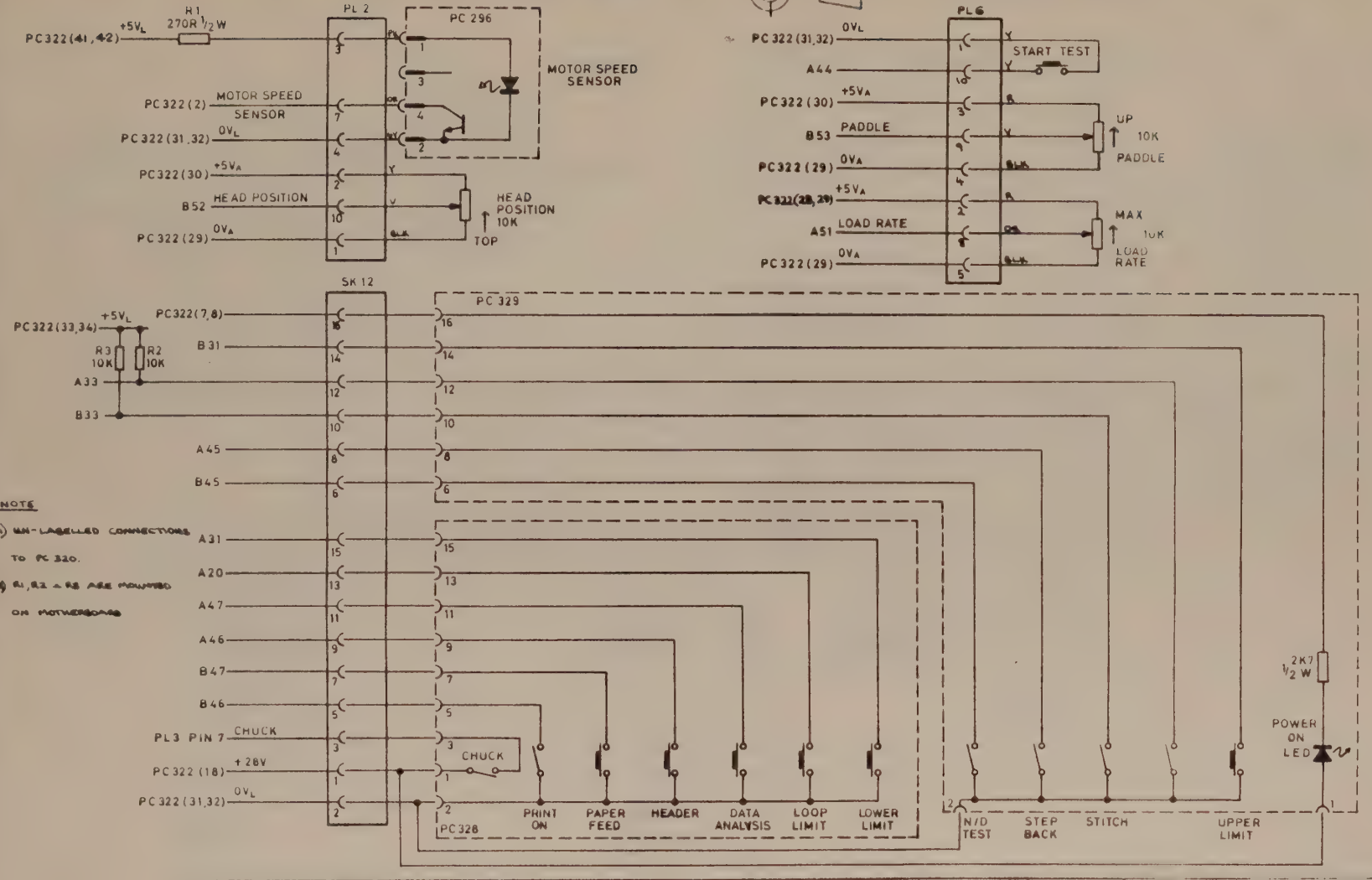

MCT 22 SWITCH/DISPLAY DATA BUS
3rd ANGLE PROJ.
DO NOT SCALE
MNE 1004
4-7-8
ISSUE
SK9
PC 288
A
B
C
D
1N4148 D1 TO D22 FAIL CODE KEYS
PC320 (B24)
COM.
SK8
(1)
(2)
(4)
(8)
12 x IN4148
LSB 1's
10's
MSB 100's
PC320 (B49)
PC320 (B32)
PC320 (A32)
THUMBWHEEL SWITCHES PC 291
PL1 PC 320
+5VA Q
0VA BLK
SIGNAL
PL11
PC320 (B22)
PC320 (B21)
PC322 (B3,B4)
PC322 (B1,B2)
Y
+5V (GR)
0V (BLK)
W
GY
BN/R
W/R
REAR VIEW OF LOAD CARTRIDGE SOCKET
IC1 74LS125
PC322 (B3,B4) +5VL
0.01μF
0V PC322 (B1,B2)
TOL
FRAC ± 1/64"
DEC ± .005
MATL
FINISH
DRAWN
No. OFF
PART
FAIL CODE KEYBOARD
THUMBWHEEL
HEAD SOCKET
INTERCONNECTIONS TO MOTHERBOARD
USED ON
MCT 22
DAGE PRECIMA INTERNATIONAL
colchester u.k.
DRG No
A3—18025
DATE

3rd ANGLE PROJ.

DO NOT SCALE

MNE 1004

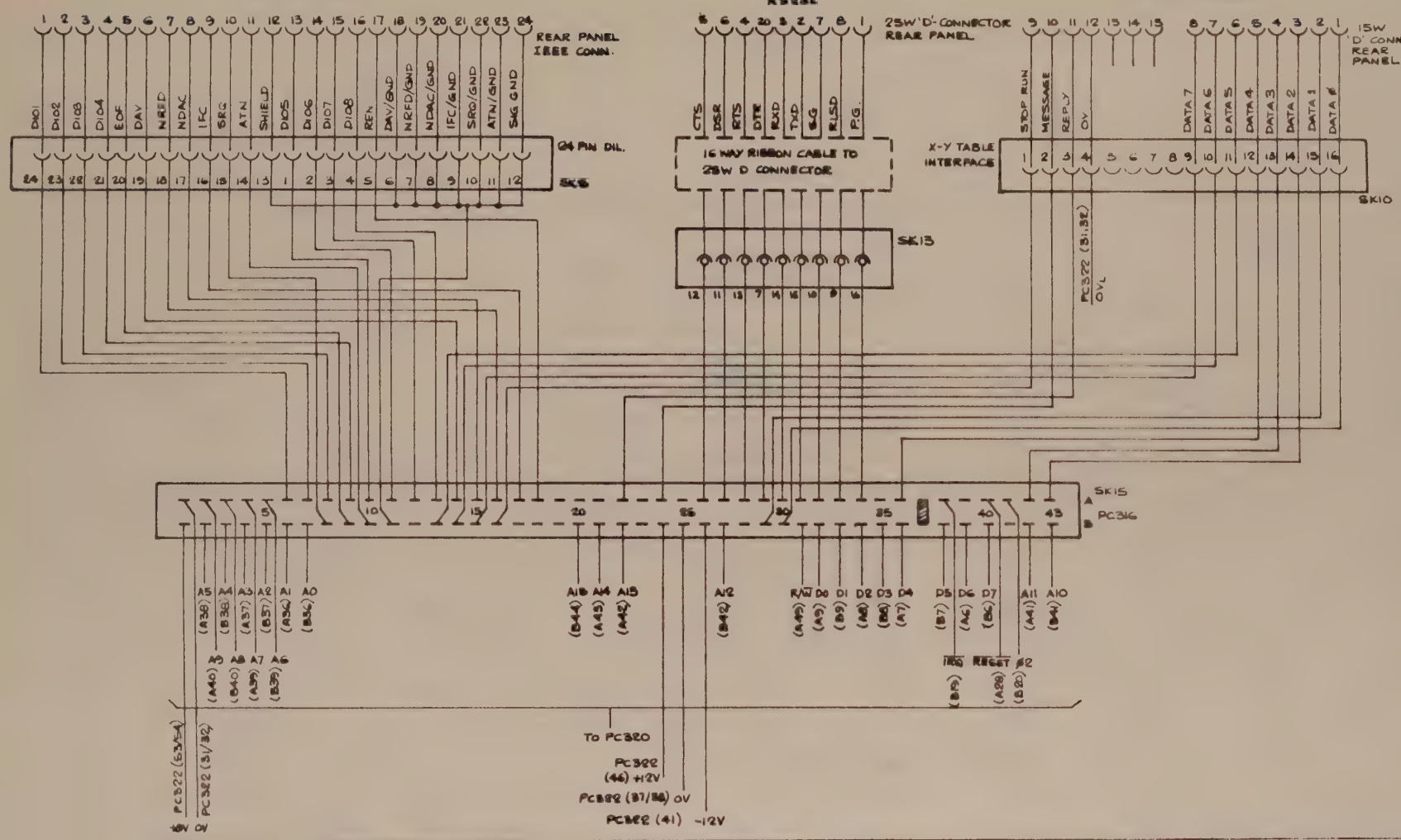
3-7-85



TOL	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
DRAWN / No. OFF	PART: ANALOGUE INPUTS, MOTOR SPEED CONTROL AND FRONT PANEL SWITCHES (PC329)	USED ON: MCT 22	DRG No: A3—18026

3rd ANGLE PROJ.

DO NOT SCALE



TOL FRAC ± .04" DEC ± .005"	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
DRAWN / No OFF	PART PC316 (IEEE RS232 X-Y TABLE) MOTHERBOARD CONNECTIONS	USED ON MCT 22	DRG No A3— 18027

MNE 1.0.04

3-7-82

ISSUE

ISSUE

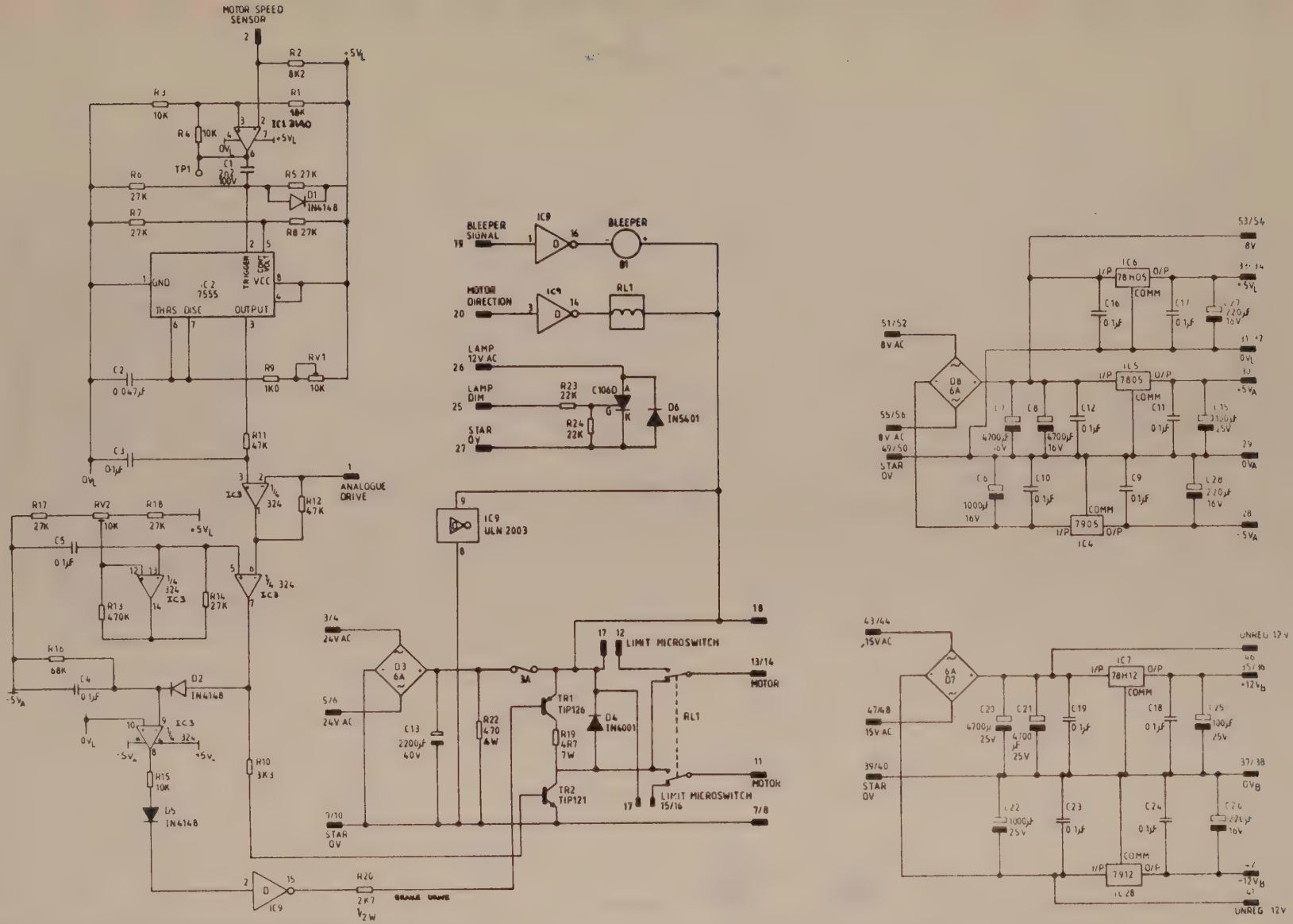
ISSUE 5

ISSUE 6

ISSUE 7

J.W 2312

DATE



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MATERIAL –

FINISH –

NOTES. –

ISSUE	MODIFICATION	DATE
	ORIGINAL	

DRN CHRIS EELS	DATE 21-6-85
CHKD	DATE
GEN. TOL. ±	ANGLES ± 0° 30'
DIMS IN	SCALE

FOR EXPLANATION OF DIMENSIONS, TOLERANCES, NOTES, ETC SEE BS 308

Dage Applied Technology Division

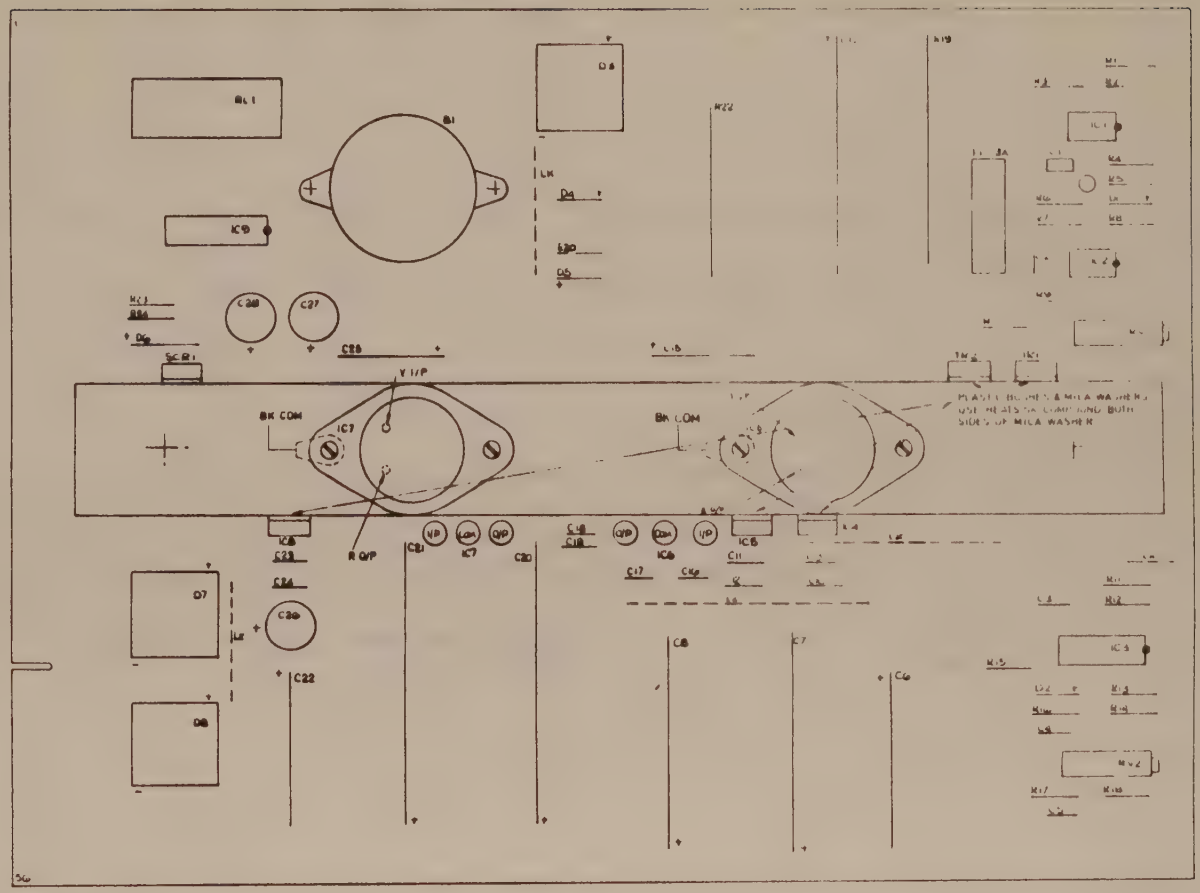
TITLE
POWER SUPPLY AND MOTOR DRIVE PC322A

DRAWING No
A2-17844

SHEET OF

REF	VALUE	REF	VALUE	REF	TYPE
R1	10K	C1	2n2	D1	IN4148
R2	8K2	C2	0µ047	D2	IN4148
R3	10K	C3	0µ1	D3	6A BRIDGE
R4	10K	C4	0µ1	D4	IN4001
R5	27K	C5	0µ1	D5	IN4148
R6	27K	C6	1000µ 16V	D6	IN5401
R7	27K	C7	4700µ 16V	D7	6A BRIDGE
R8	27K	C8	4700µ 16V	D8	6A BRIDGE
R9	1K0	C9	0µ1		
R10	3K3	C10	0µ1		
R11	47K	C11	0µ1	TR1	TIP126
R12	47K	C12	0µ1	TR2	TIP121
R13	470K	C13	2200µ 40V		
R14	27K	C14		K1	3190
R15	10K	C15	100µ 25V	IC2	7555
R16	68K	C16	0µ1	IC3	324
R17	27K	C17	0µ1	IC4	7305
R18	27K	C18	0µ1	IC5	7805
R19	4R7 7W	C19	0µ1	IC6	78H05
R20	2K7 ¼W	C20	4700µ 25V	IC7	78H12
R21		C21	4700µ 25V	IC8	7912
R22	470R 6W	C22	1000µ 25V	IC9	WM 208AM
R23	22K	C23	0µ1		
R24	22K	C24	0µ1	SCR1	C106B
R25		C25	100µ 25V		
R26		C26-28	220µ 16V		
RV1	10K	RL1	24V DC 7698		
RV2	10K		SPC/a(ma-sm)		

ALL RESISTORS ¼W UNLESS OTHERWISE STATED



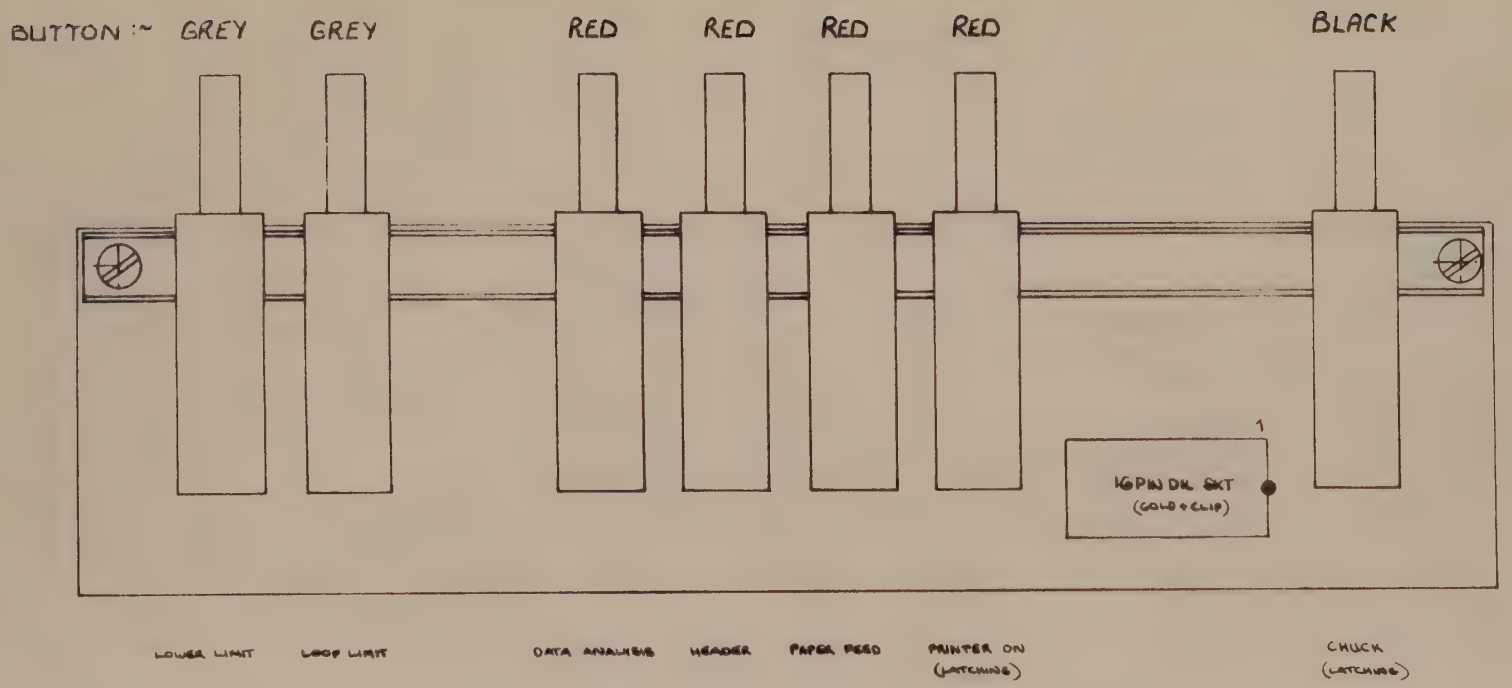
MICA WASHER
USE HEATSINK COMPOUND
BOTH SIDES OF MICA WASHER

ISSUE B ME 1004 10-7-85	ISSUE C	ISSUE D	ISSUE	ISSUE E	ISSUE F	TOL. FRAC ±1/64" DEC ± .005"	MATL.	FINISH	Applied Technology Division
						DRAWN dm 10-7-85	No. OFF	PART COMPONENT LAYOUT FOR PC 322	USED ON MET 22	DRG. No A1
									DATE

3rd ANGLE PROJ.

DO NOT SCALE

MNE 1004
5-7-85



TOL DEC ± 005	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
DRAWN: dmh / No. OFF	PART: COMPONENT LAYOUT FOR PC328	USED ON: MCT 22	DRG NO: A3— 16296

31-8-82

3rd ANGLE PROJ.

DO NOT SCALE

MNE 10004

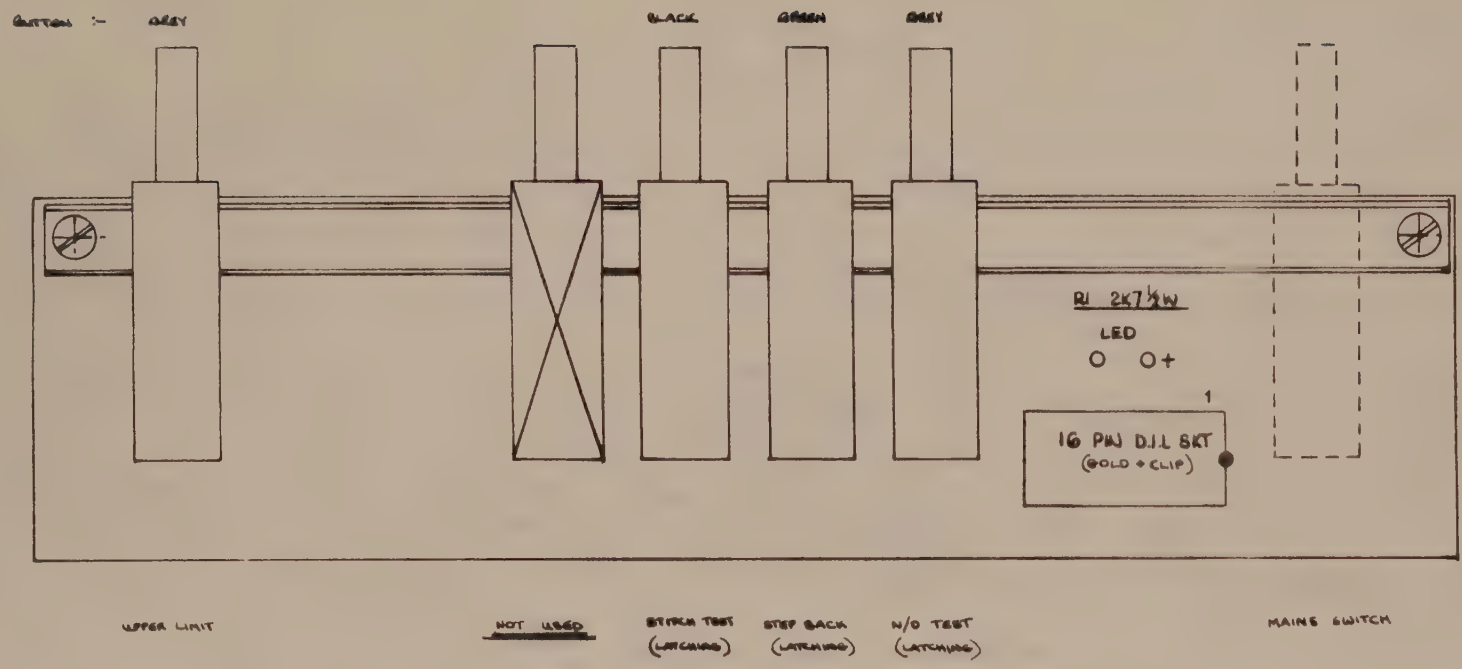
3-7-85

ISSUE

ISSUE

ISSUE

ISSUE



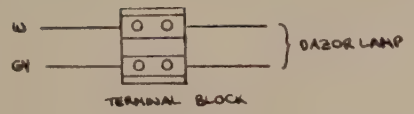
NOTE : ROLLER ON BUTTON - RED

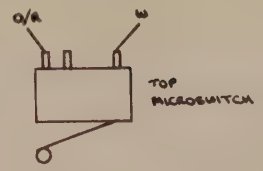
TOL	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
FRAC ± 1/64" DEC ± .005"			
DRAWN: dmh / No. OFF:	PART: COMPONENT LAYOUT FOR PC329	USED ON: MCT 22	DRG No: A3--16297

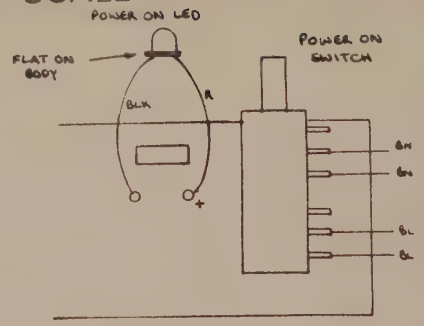
51-8-82

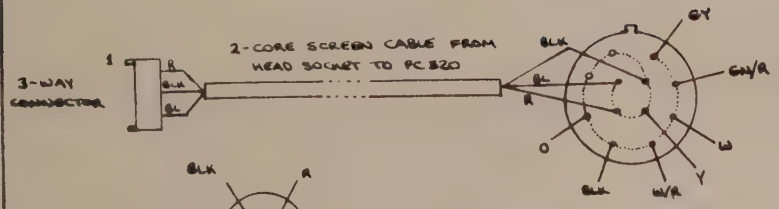
3rd ANGLE PROJ.

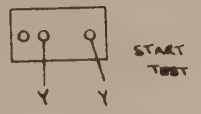
DO NOT SCALE

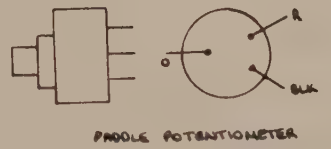


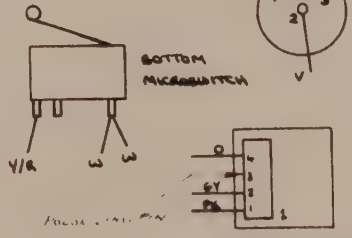


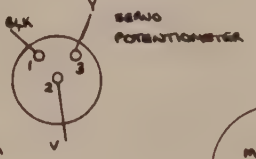


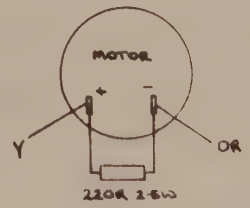


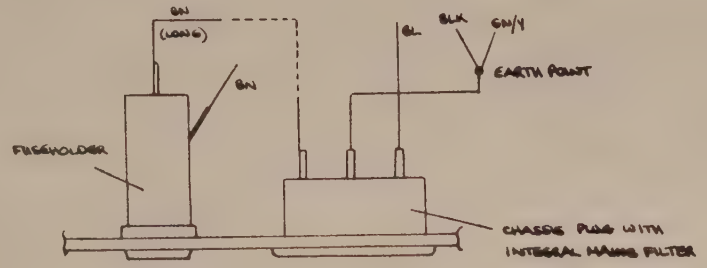












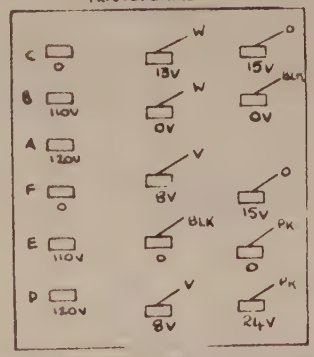
LINKS

GN — L
BL — N

240V - L-A, N-F, LINK C&D

220V - L-B, N-F, LINK C&E

110V - L-B-E, N-C-F



ISSUE 3

ISSUE A

MNE 10-4

4-7-85

ISSUE

ISSUE

ISSUE

TOL	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
FRAC ± 1/64" DEC ± .005			
DRAWN / No. OFF	PART: MAIN MACHINE WIRING (EXCLUDING MOTHERBOARD)	USED ON: MCT 22	DRG No: A3—18028

DATE

JW 2312

3rd ANGLE PROJ.

DO NOT SCALE

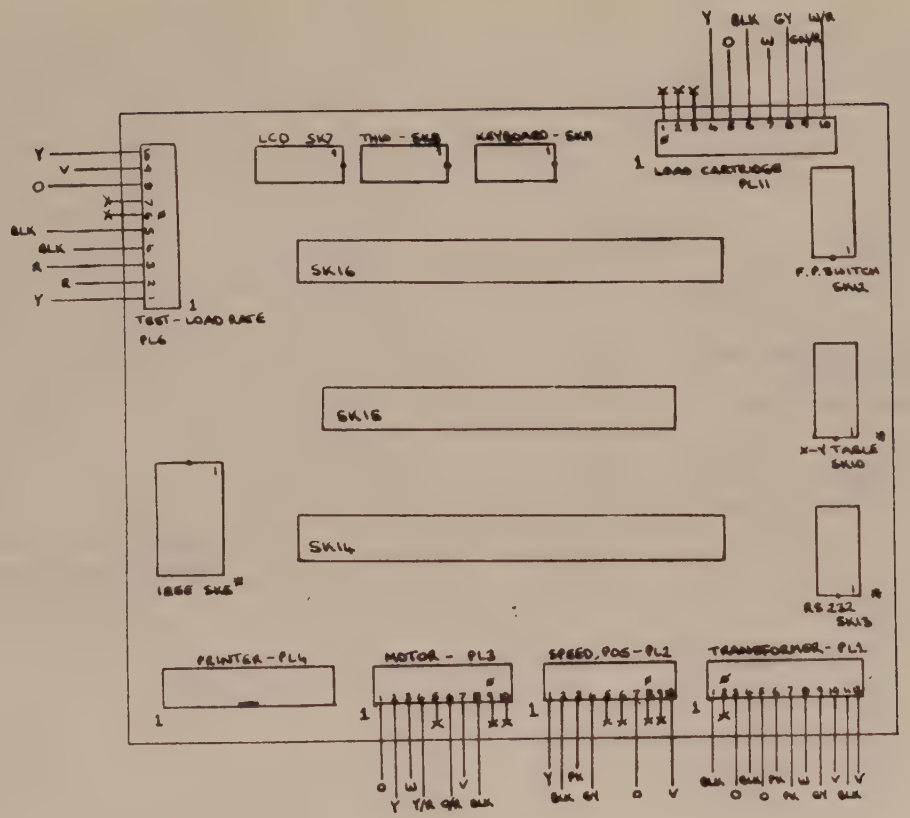
MNE 1.0.24

3 - 7

ISSUE 3

ISSUE 4

ISSUE 5



* OPTIONAL

Ø POLARIZATION

TOL FRAC ± .04 DEC ± .005	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
DRAWN / NO OFF	PART: MOTHERBOARD WIRING	USED ON: MCT 22	DWG No: A3— 18029

DATE

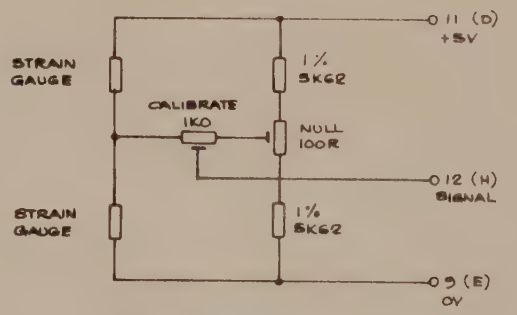
J.W 8312

3rd ANGLE PROJ. DO NOT SCALE

LOAD CARTRIDGE	PIN IDENTIFICATION MCT 22				MCT 15/20			
	1	2	3	4	A	B	C	F
5gm	\	\	\	\	X	X	X	X
10gm	\	\	\	0	X	X	X	X
20gm	\	\	0	\	0	\	\	\
50gm	\	\	0	0	0	0	\	\
100gm	\	0	\	\	0	\	\	0
200gm	\	0	\	0	0	\	0	\
500gm	\	0	0	\	0	0	0	\
1Kg	\	0	0	0	0	\	0	0
2Kg	0	\	\	\	\	\	0	\
5Kg	0	\	\	0	\	0	0	\
10Kg	0	\	0	\	\	\	0	0

NOTES

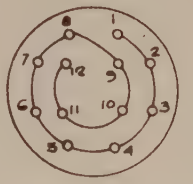
1. X NOT AVAILABLE
2. 0 NO CONNECTION
3. \ LINK TO PIN 5 - MCT 22 (PIN E - MCT 15/20)
4. LOW DEFLECTION CARTRIDGE FOR USE ON MCT 22 LINK PIN 10 TO 5 (+ VALUE IDENTIFICATION)



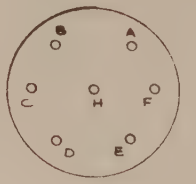
LOAD CARTRIDGE - STRAIN GAUGE CONNECTIONS

TWIN CORE SCREENED CABLE

	MCT 22	MCT 15/20
BLUE	12	H
RED	11	D
BLACK	9	E



MCT 22



MCT 20

REAR VIEW OF PANEL SOCKETS

ISSUE 2

ISSUE A

MNE 1004

ISSUE 4

ISSUE 5

ISSUE 6

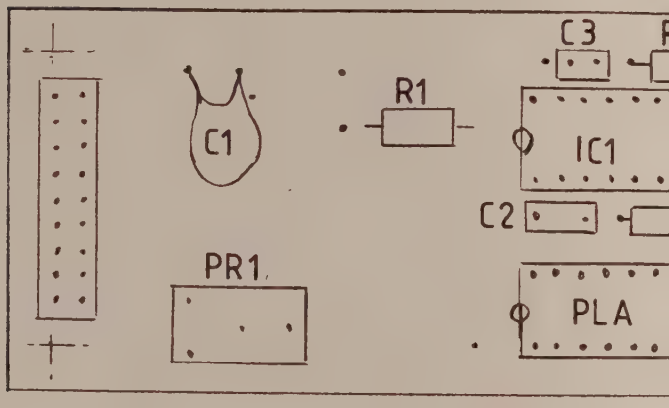
ISSUE 7

TOL	MATL	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.
FRAC ± 1/64" DEC. ± .005"			
DRAWN / No. OFF	PART: MCT 22 LOAD CARTRIDGE CONNECTIONS	USED ON: MCT 22	DRG No: A3— 18030

TW 2312

DATE

OJECTION	IF IN DOUBT ASK	



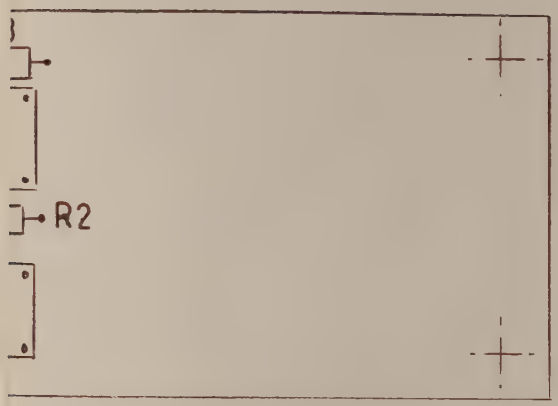
REF	VALUE
C1	4.7µF
C2	0.47µF
C3	2.2nF
R1	4K7
R2	10K
R3	22K
PR1	47K
IC1	4528
PLA	16 WAY

S DRAWING IS THE PROPERTY OF DAGE AND MUST NOT BE USED OR REPRODUCED WITHOUT WRITTEN CONSENT

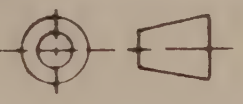
TERIAL: –				DR
IISH: –				CH
TES: –				GE
				DIM
		ORIGINAL		HO
R EXPLANATION OF DIMENSIONS, TOLERANCES, NOTES, ETC., SEE BS 308.	ISSUE	MODIFICATION	DATE	

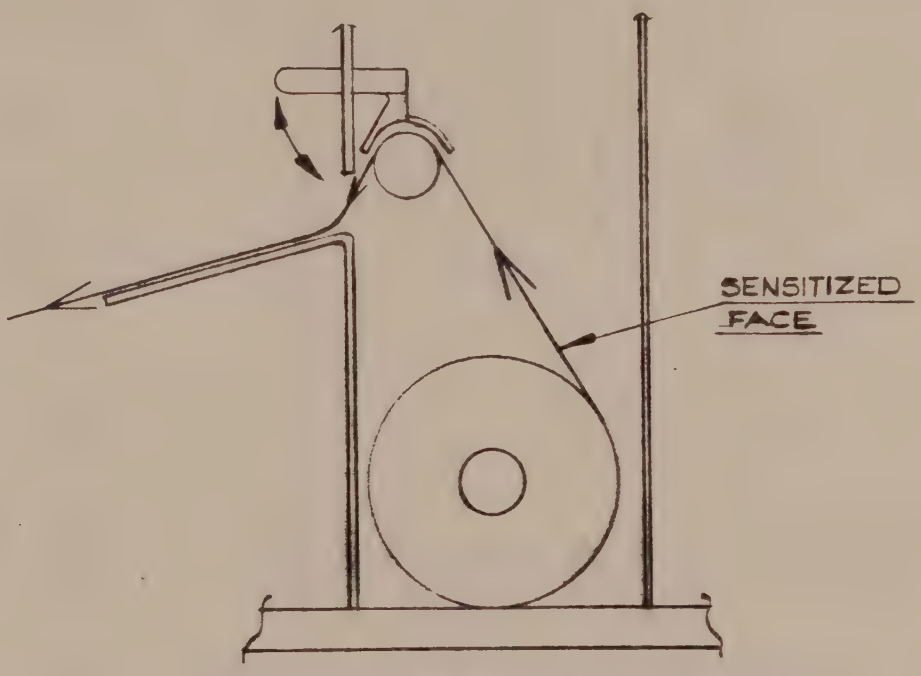
1485/359

REMOVE ALL BURRS AND SHARP EDGES	DO NOT SCALE



. A.J.B.	DATE 30.10.87	Dage Applied Technology Division Rabans Lane, Aylesbury, Bucks. HP19 3RG. Telephone (0296) 33200 Telex 83518	TITLE COMPONENT LAYOUT FOR PC406B
D.	DES.		
. TOL. ±	ANGLES ± 0° 30'		
S. IN	SCALE		DRAWING No. A3- 700193
ES ⊕	GEN. 1·6		SHEET OF

3rd ANGLE PROJ  DO NOT SCALE



PRINTER PAPER LOADING DIAGRAM

ISSUE 2	ISSUE 3	ISSUE 4	ISSUE 5	ISSUE 6	ISSUE 7

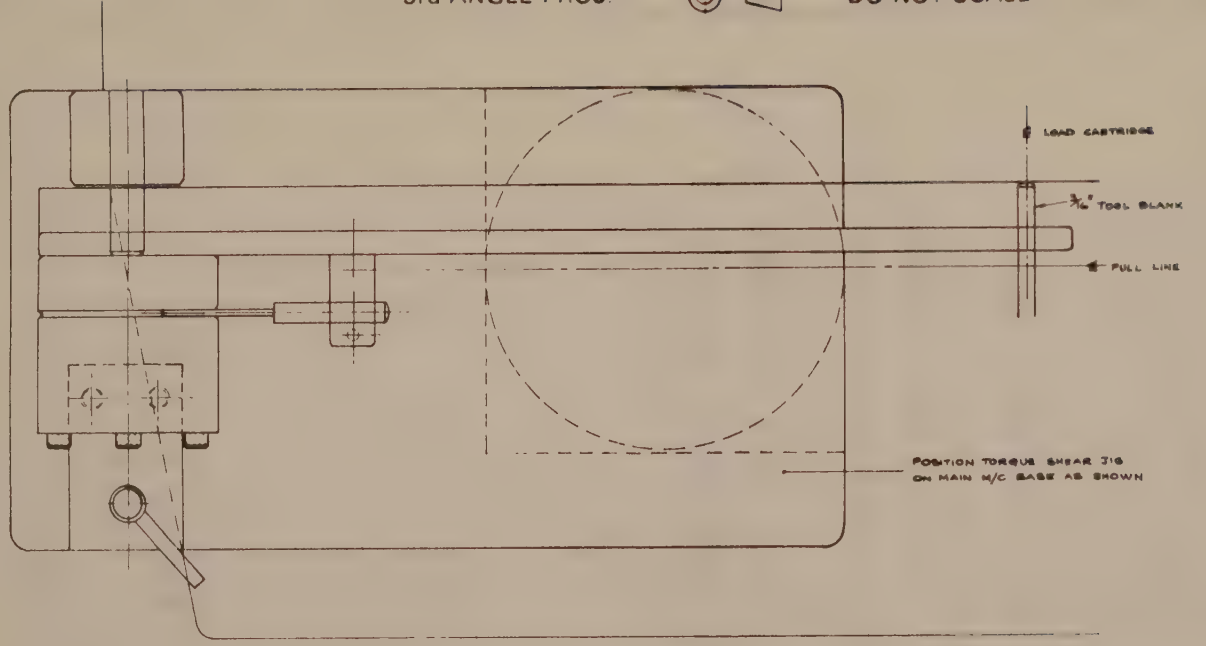
TOL.	MATL.	FINISH	
Frac. ±1/64" Dec. ±.005"			DAGE PRECIMA INTERNATIONAL colchester u.k.

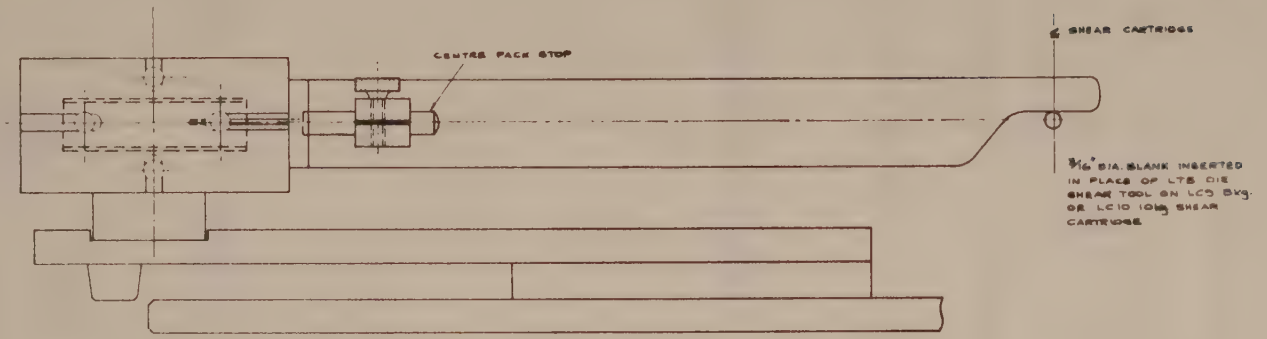
N. OFF	PART	USED ON	DRG. No.
DRAWN A.J.M.	PRINTER PAPER LOADING DIAGRAM	M.C.T.-20	A4-14245

J.W. 2313

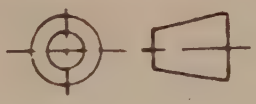
8289LT/6251

DATE 13-11-8





		MAT'L	FINISH	Dage Applied Technology Division
DRAWN	No OFF	PART WH 5 TORQUE SHEAR JIG POSITIONAL DATA	USED IN	DRG. No A2 164

3rd ANGLE PROJ  DO NOT SCALE

WHS INSTRUCTIONS

WHEN USING WHS TORQUE SHEAR JIG ON MCT 20

1. WHS TORQUE SHEAR JIG MAY ONLY BE USED IN CONJUNCTION WITH LC 33 5 kg SHEAR OR LC 32 10 kg SHEAR CARTRIDGES.
2. A 3/16" DIA BLANK DOWEL MUST BE INSERTED IN PLACE OF THE DIE SHEAR TOOL.
3. REMOVE LEFT HAND ARM REST FROM MCT 20 BY REMOVING 2 OFF SCREWS BELOW BASE
4. POSITION THE TORQUE SHEAR JIG AS SHOWN IN THE DRAWING ENCLOSED
5. SET THE UPPER LIMIT SWITCH SO THAT THE TORQUE LOAD ARM MAY ONLY BE PULLED TO ITS OWN LIMIT OF TRAVEL.
6. SET THE PACKAGE STOP ON THE WHS SO THAT THE PACKAGE IS CENTRAL ABOUT THE PIVOT.
7. CLOSE UP EACH OF THE FRONT FOUR JAWS SO THAT PACKAGE LID IS HELD SECURELY AND LOCK.
8. PRESS TEST START BUTTON
9. REMEMBER TORQUE VALUE SHOWN MUST BE MULTIPLIED BY FACTOR OF 25 = ANSWER IN Kg Cm.

ISSUE 2	ISSUE 3	ISSUE 4	ISSUE 5	ISSUE 6	ISSUE 7

TOL. Frac. ±1/64" Dec. ± 005"	MATL.	FINISH	DAGE PRECIMA INTERNATIONAL colchester u.k.

No OFF	PART	USED ON	DRG. No
DRAWN	INSTRUCTIONS FOR WHS TORQUE SHEAR JIG	MCT 20	A4—16401

JW 2313

DATE

B289_LT/625J

LIST OF PHOTOGRAPHS

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Fig.7.	Loading Paper Roll
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Fig.19.	Workholder WH3
Fig.20.	Workholder WH5
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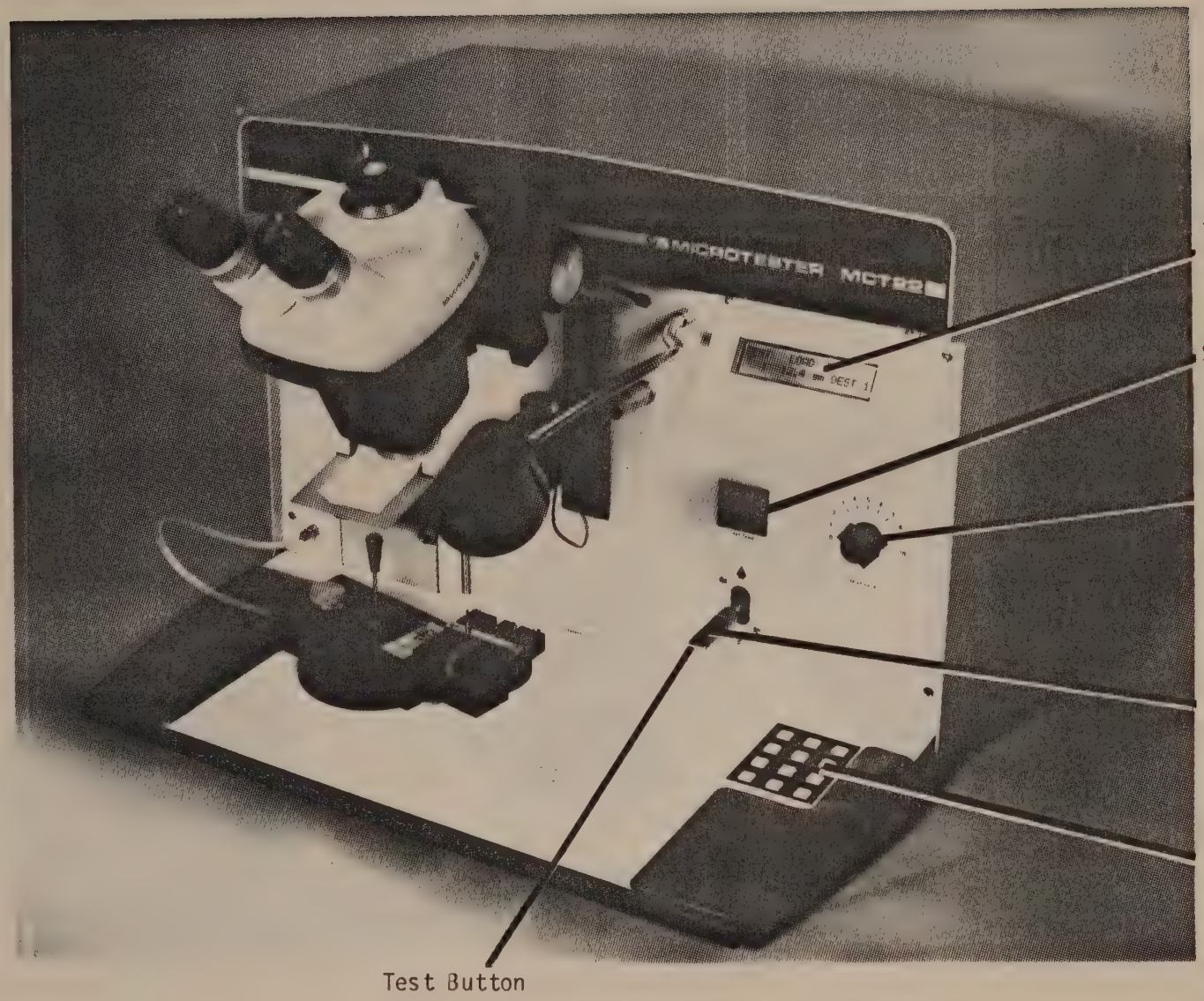
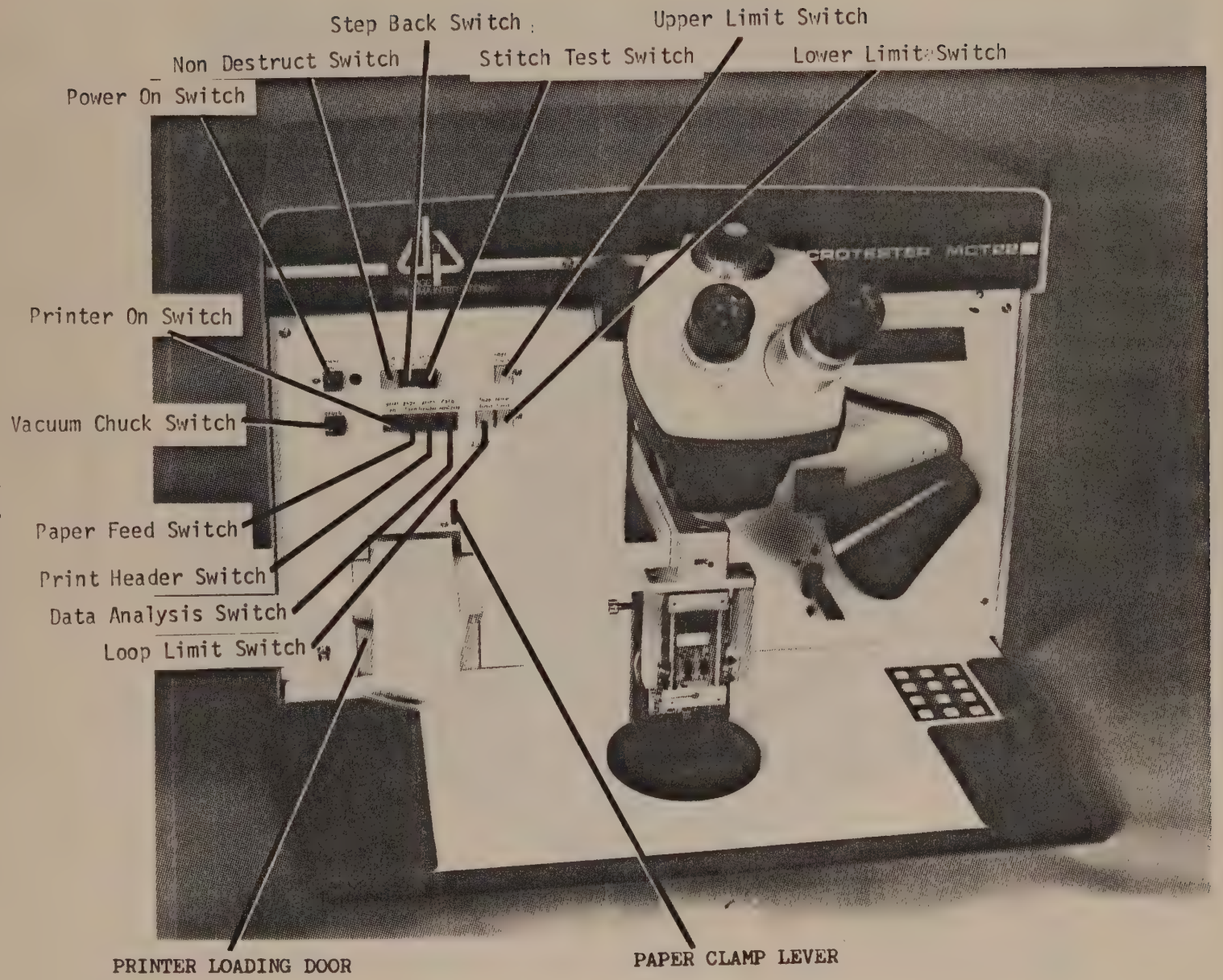
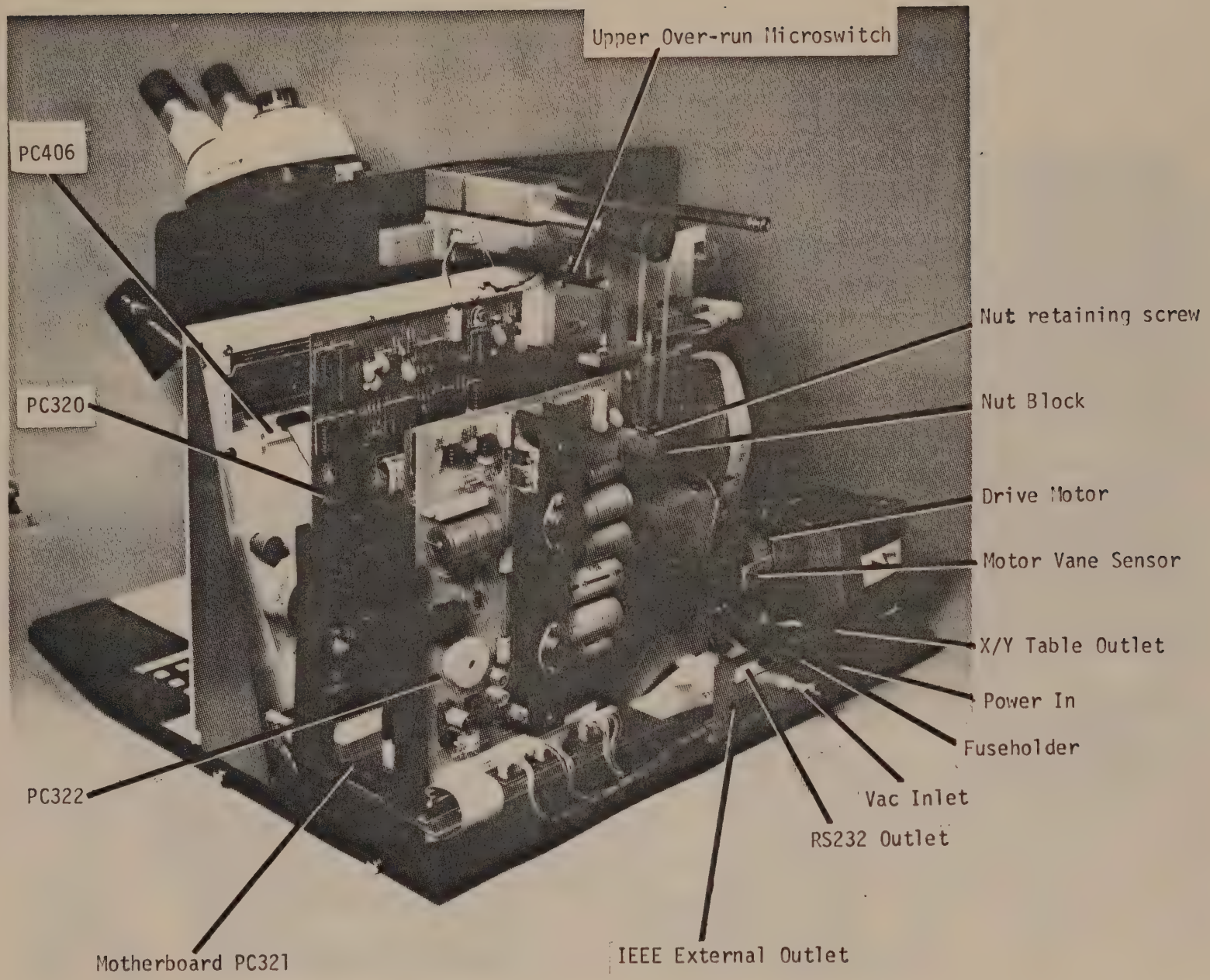


Right Hand Exterior

Fig. 1.

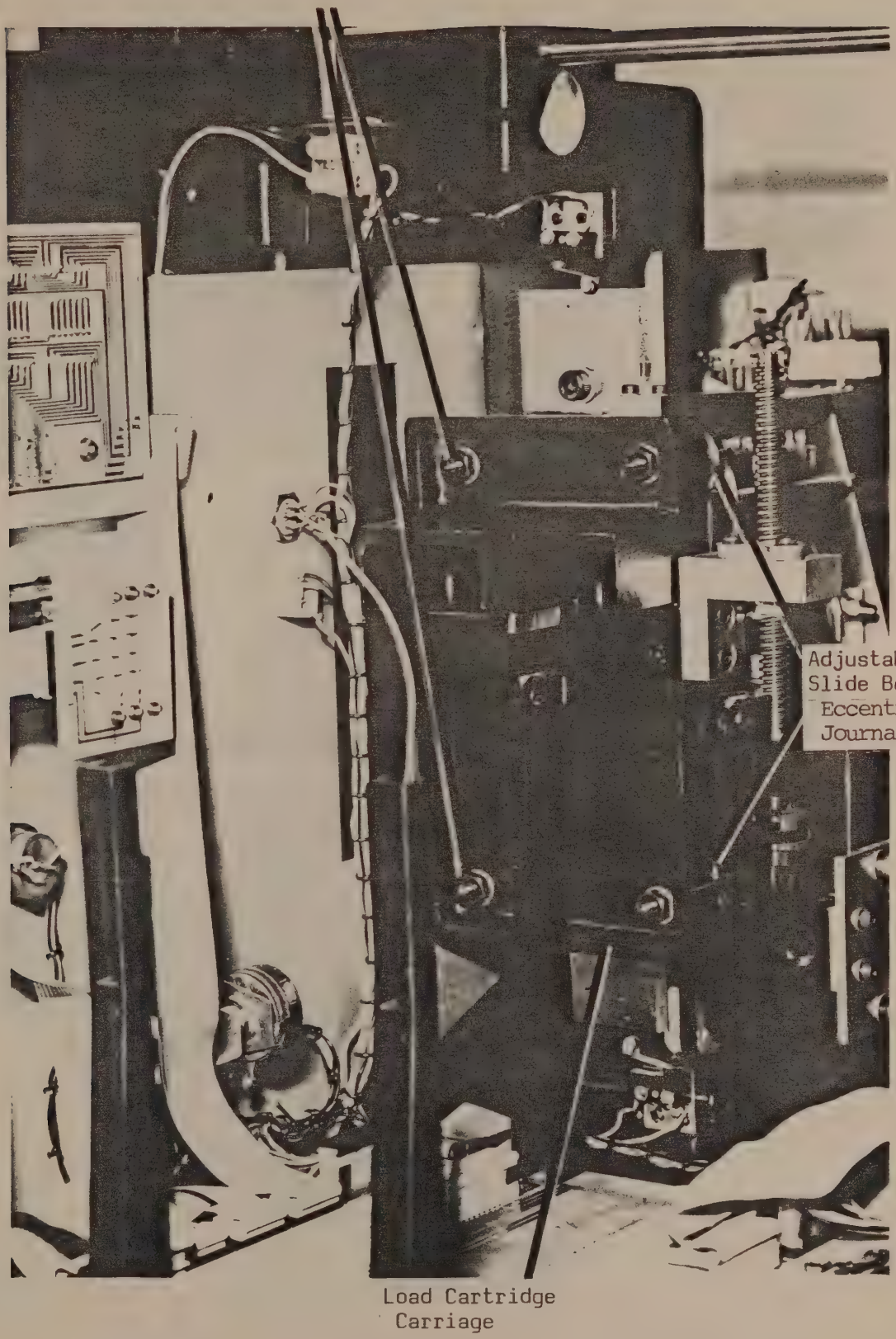


Left Hand Exterior
Fig. 2



LEFT HAND INTERIOR

Fig. 3.

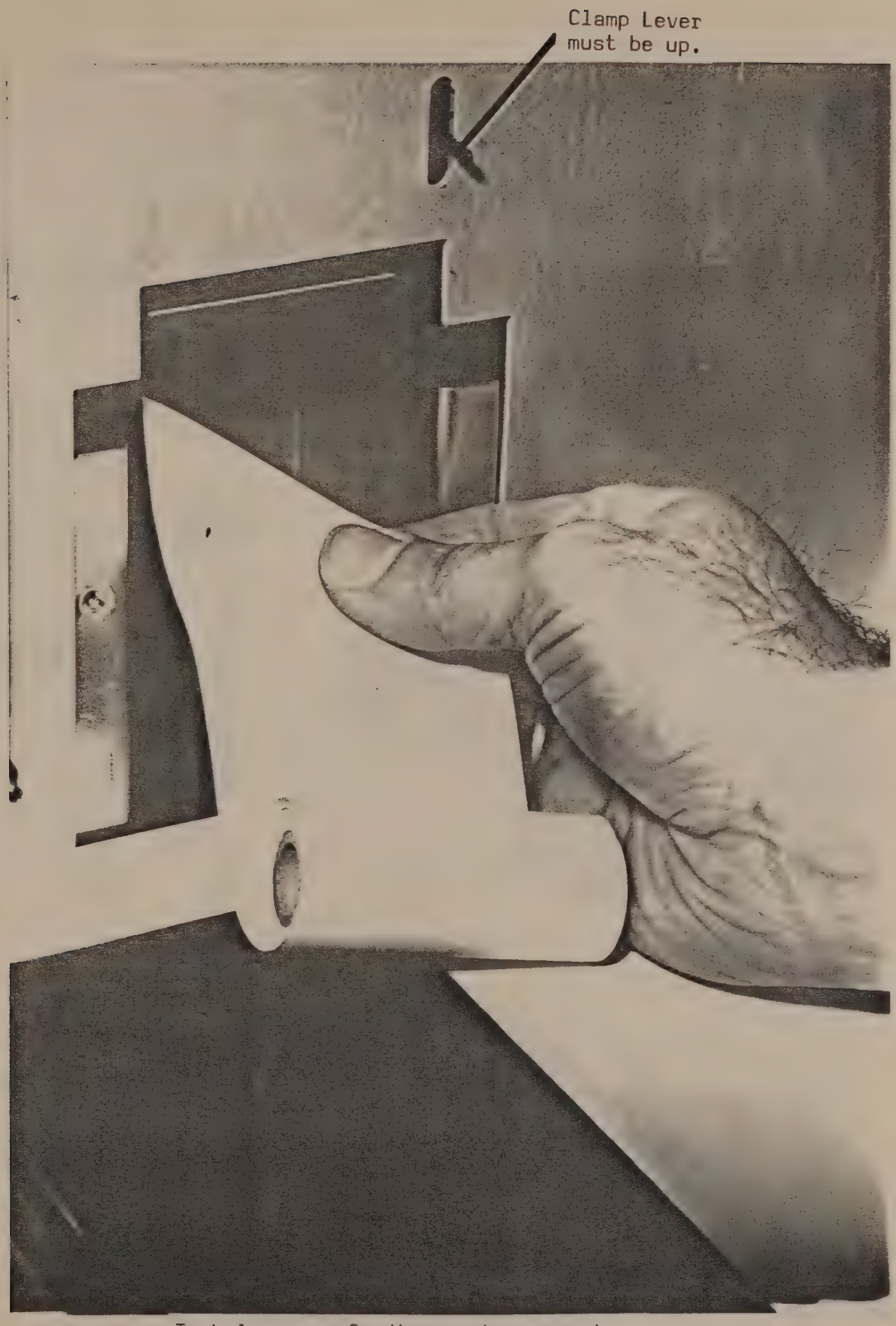


Left Hand Interior

Fig.4.

Right Hand Interior

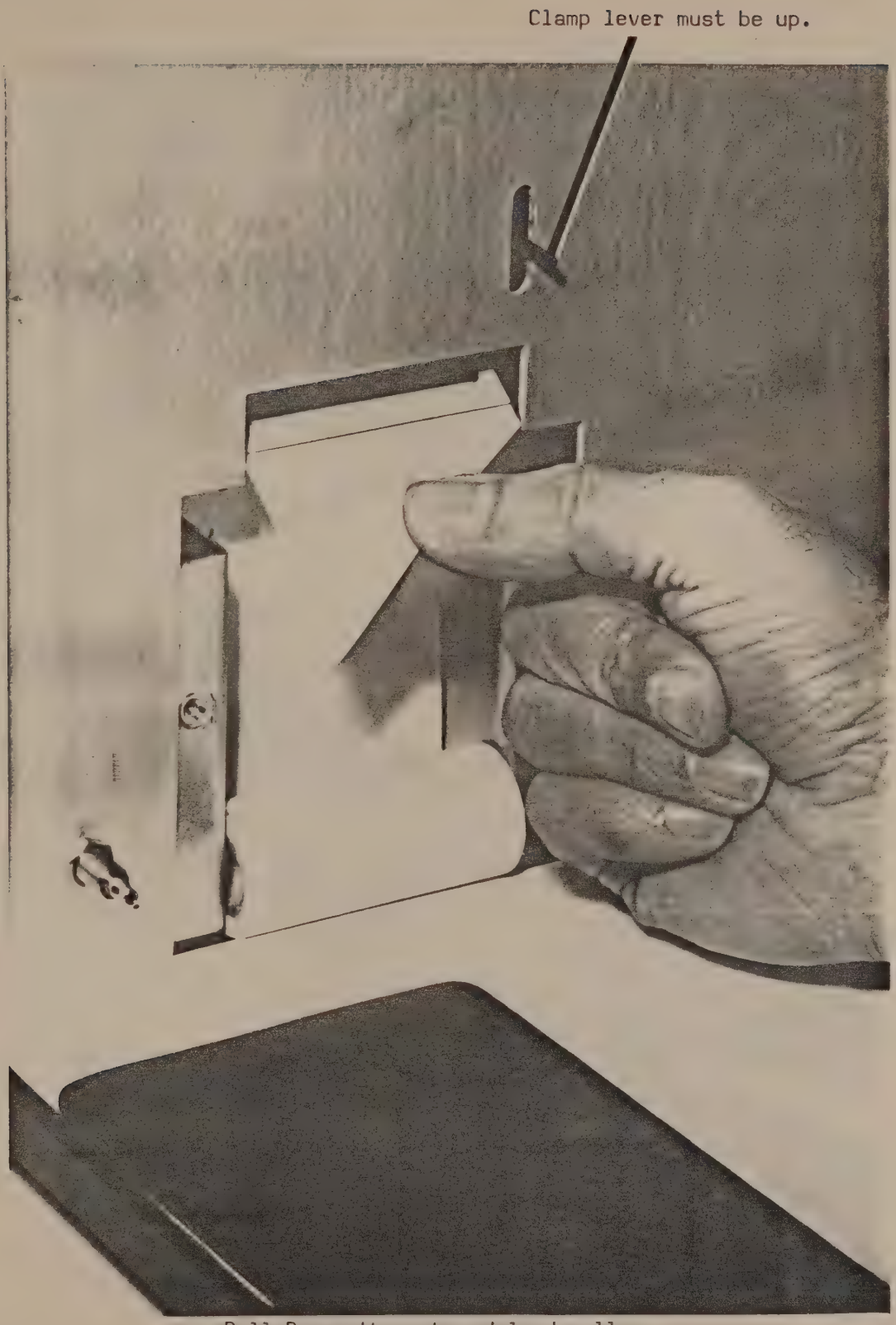
Fig. 5.



To help paper feeding, cut paper at an angle and leave roll out of machine.

Loading Paper Roll

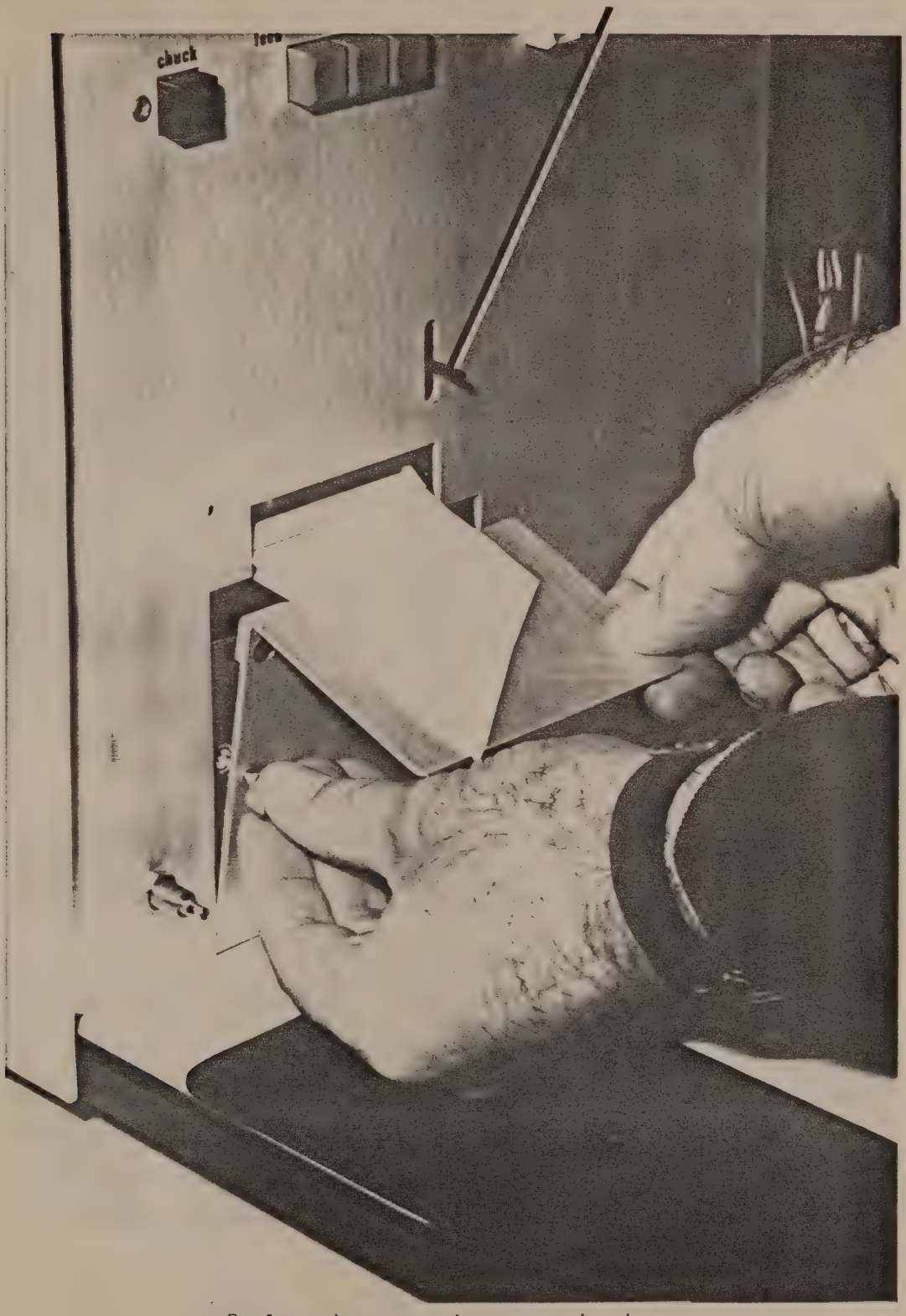
Fig.6.



Loading Paper Roll

Fig .7.

Lower lever to clamp paper.



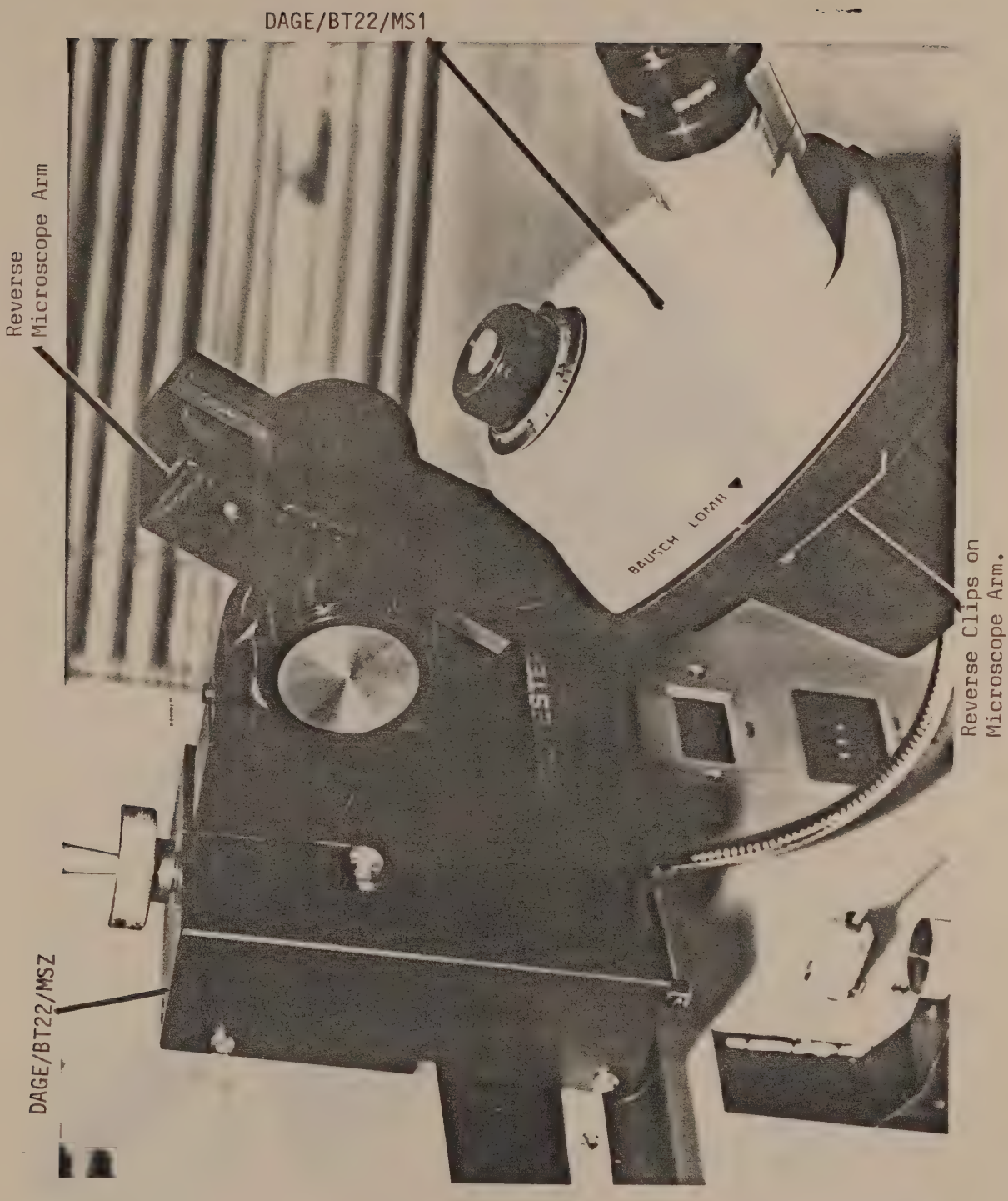
Replace door ensuring paper is above writing platform.

Loading Paper Roll.

Fig.8.

Loading Load Cartridge

Fig.9.



E04 2 inch Travel Microscope Table Accessory for use with all Shear Cartridges

Fig.10.

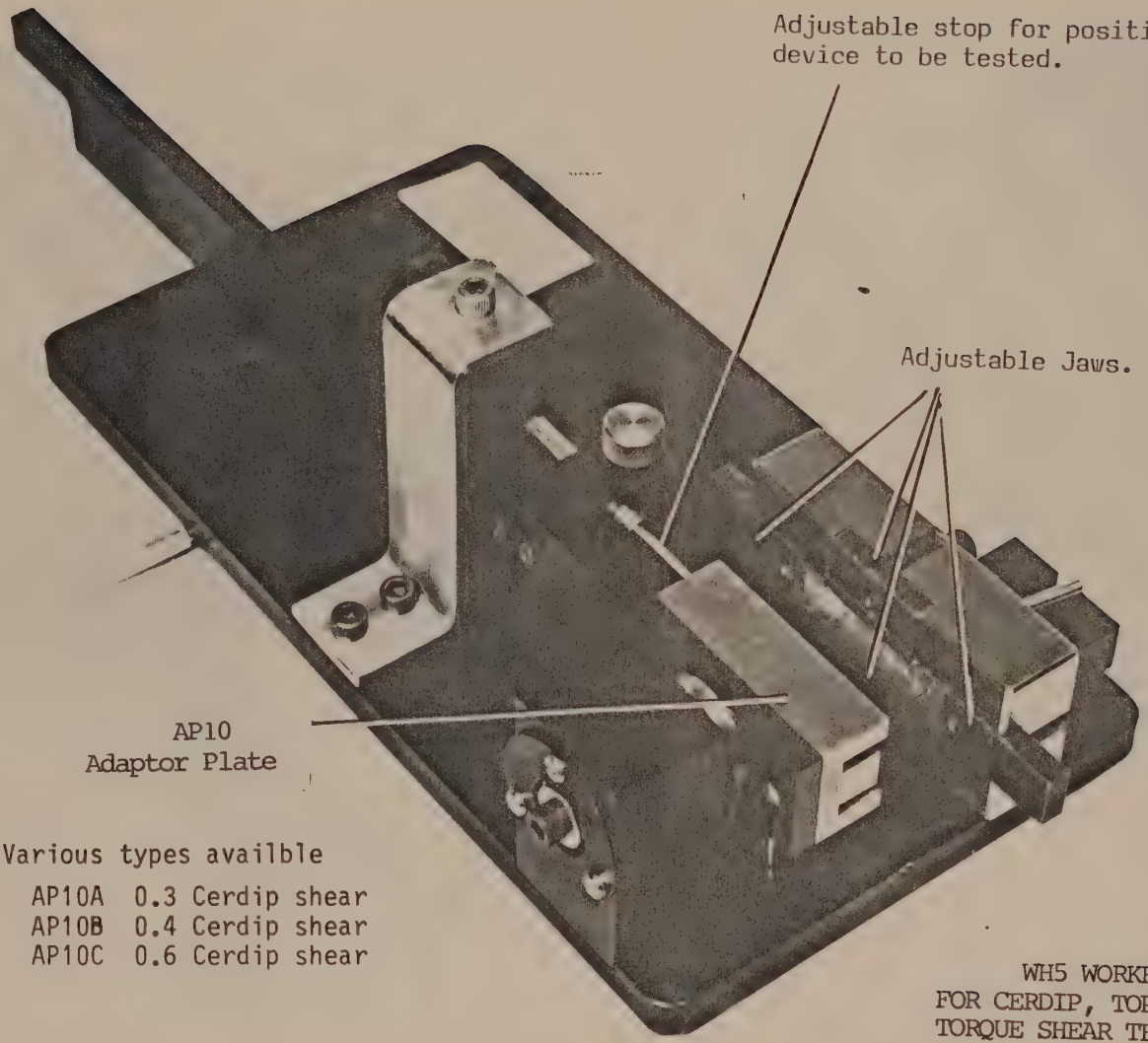
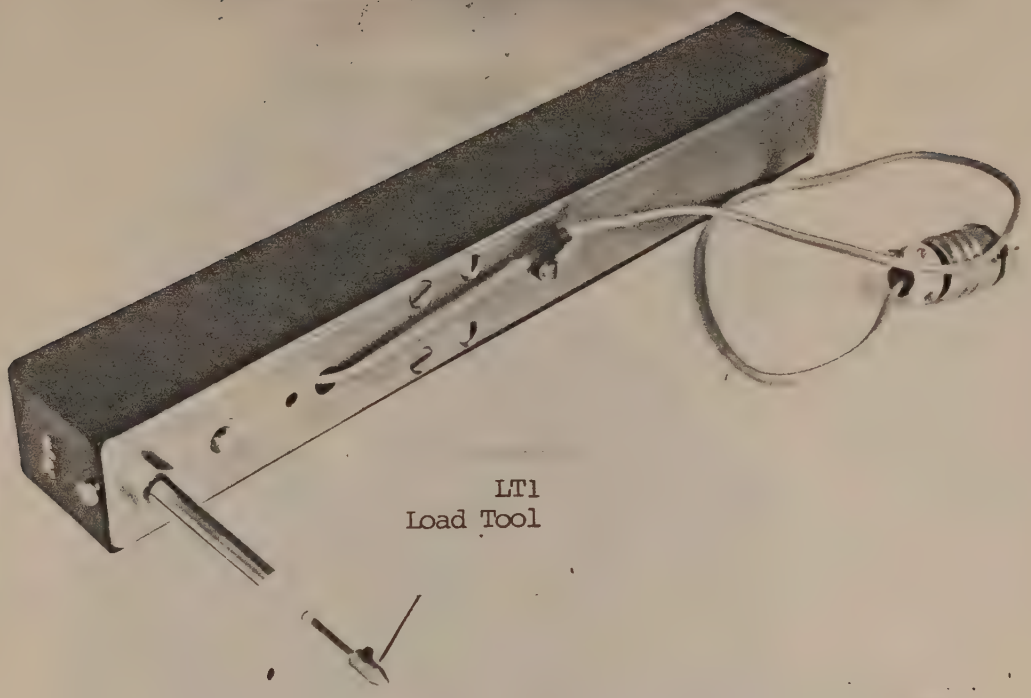
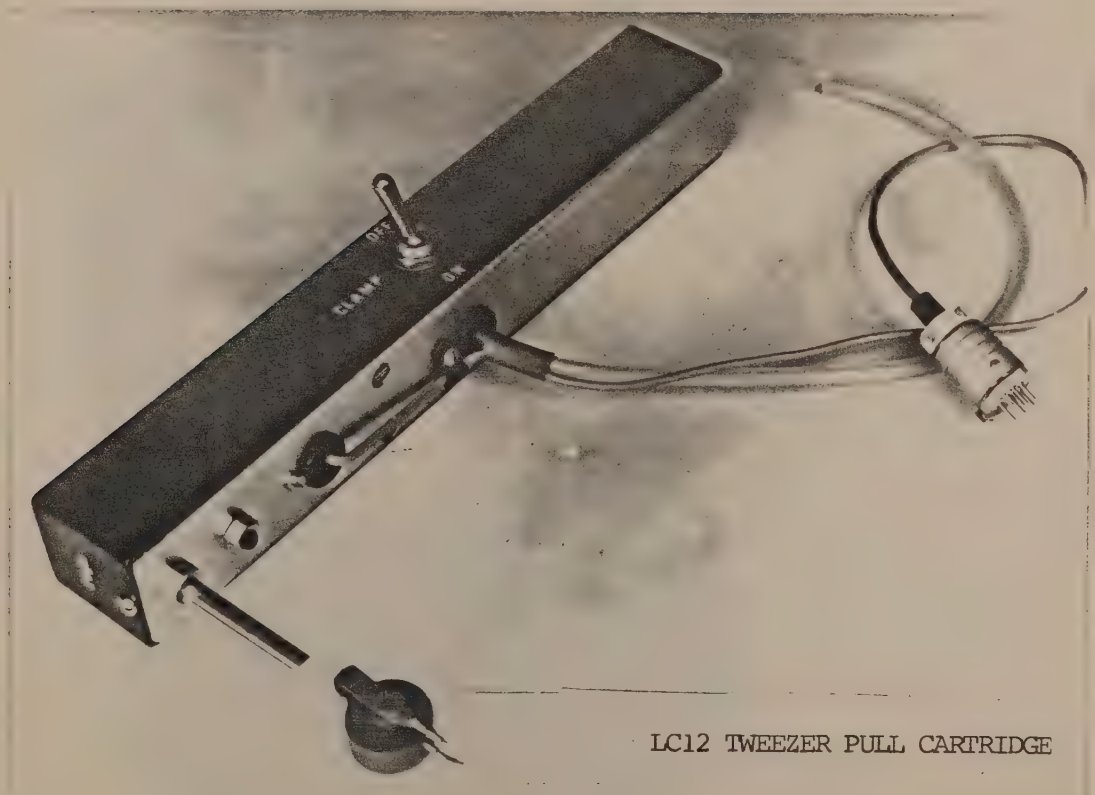

Adjustable stop for positioning device to be tested.
Adjustable Jaws.
AP10
Adaptor Plate
Various types availble
AP10A 0.3 Cerdip shear
AP10B 0.4 Cerdip shear
AP10C 0.6 Cerdip shear
WH5 WORKHOLDER
FOR CERDIP, TOP CERAMIC
TORQUE SHEAR TEST

Fig.12.



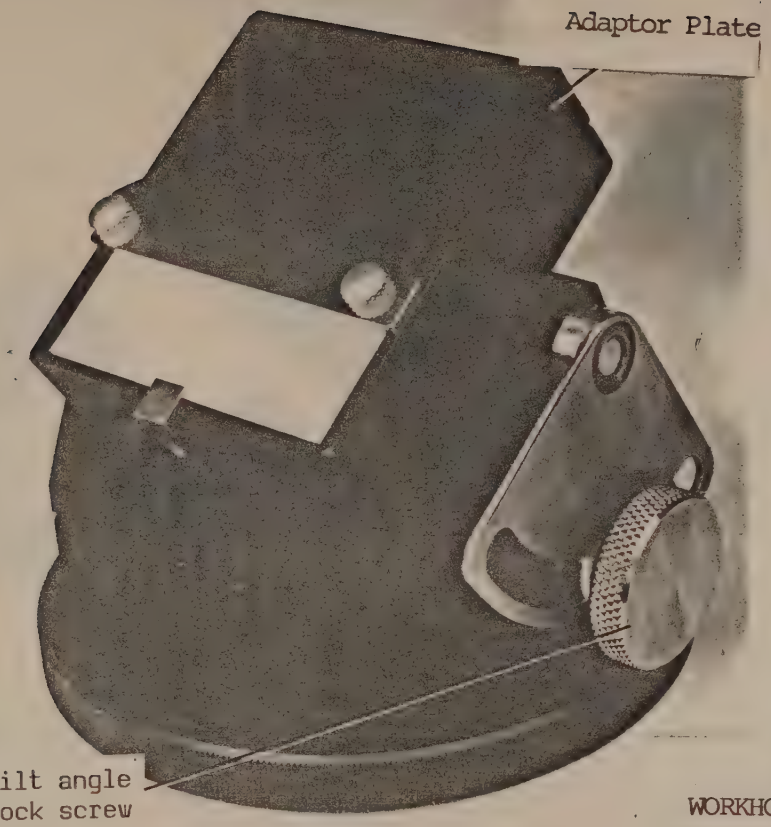
LT1
Load Tool

LC1 PULL CARTRIDGE



LC12 TWEEZER PULL CARTRIDGE

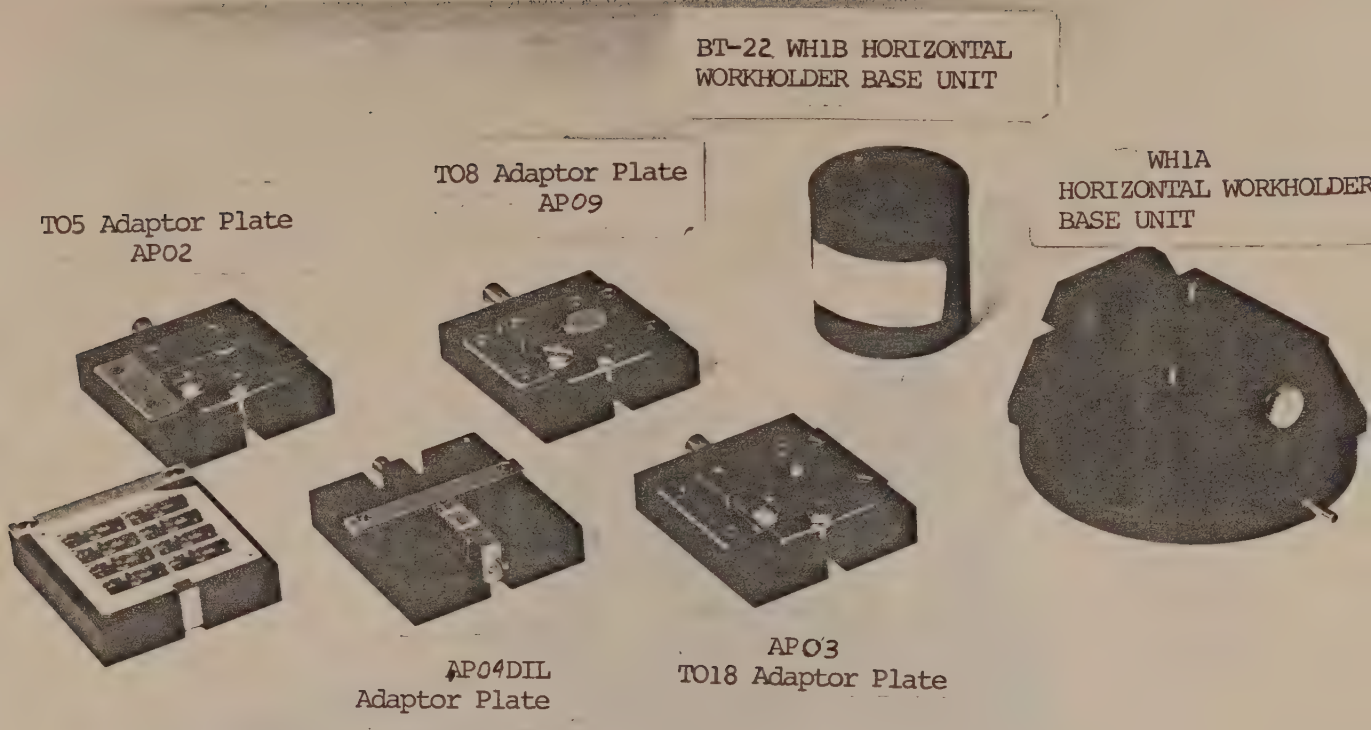
Fig.13.



WH2 VARIABLE ANGLE
WORKHOLDER BASE UNIT

WH6 HORIZONTAL/VERITCAL
WORKHOLDER BASE UNIT

Fig 17


BT-22 WH1B HORIZONTAL
WORKHOLDER BASE UNIT
TO8 Adaptor Plate
AP09
WH1A
HORIZONTAL WORKHOLDER
BASE UNIT
TO5 Adaptor Plate
AP02
AP04DIL
Adaptor Plate
AP03
TO18 Adaptor Plate
SUBSTRATE ADAPTOR PLATE

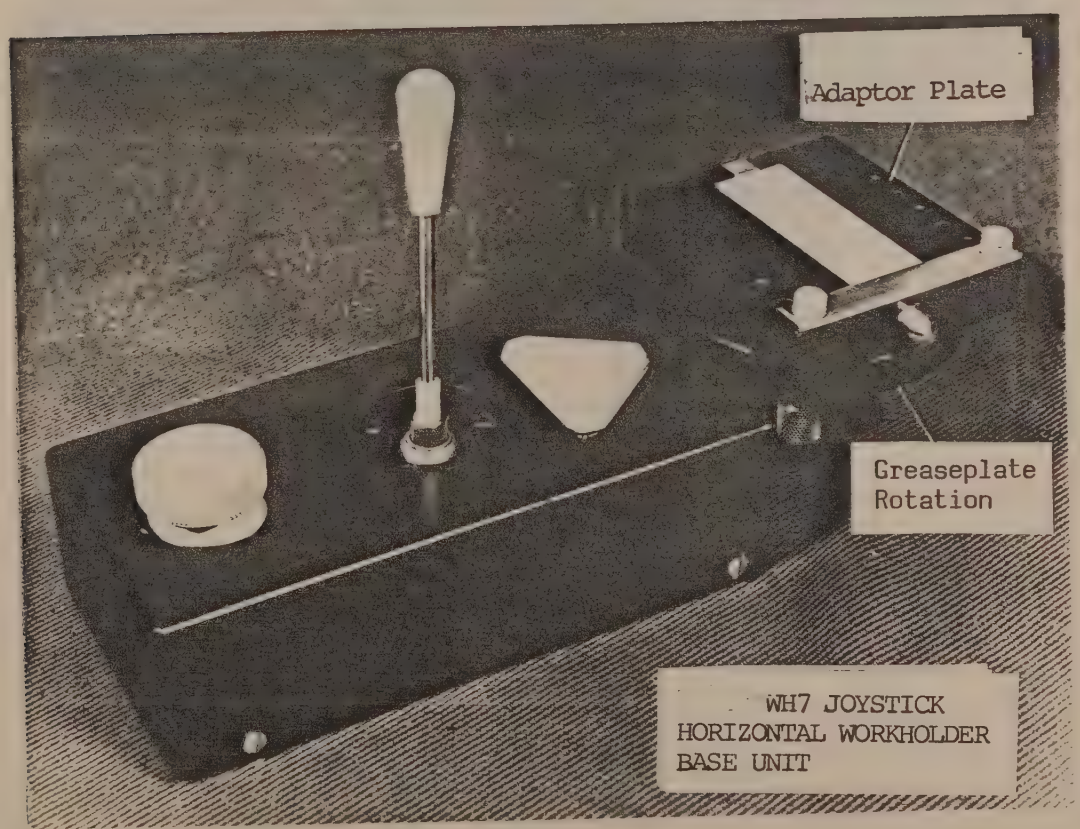
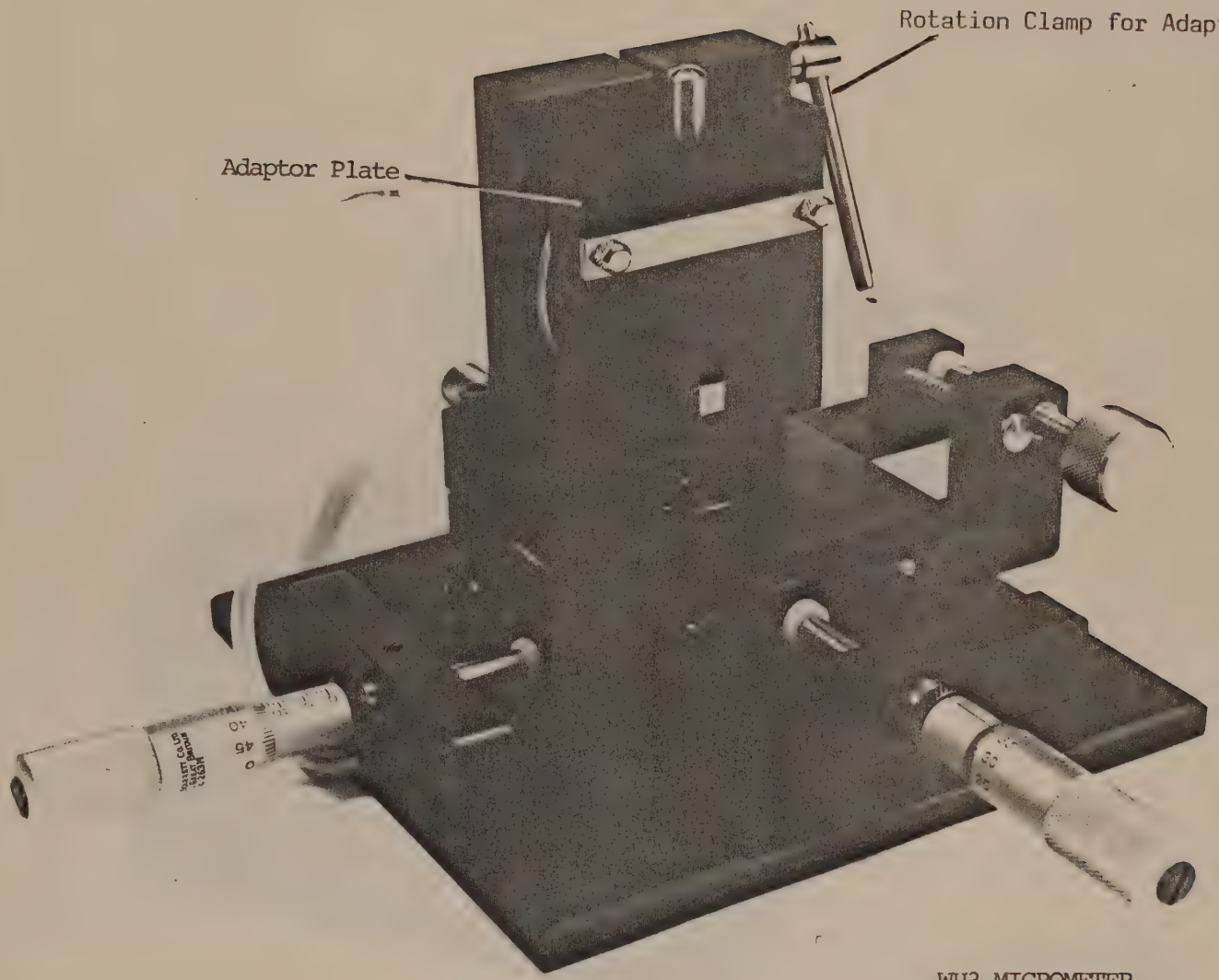
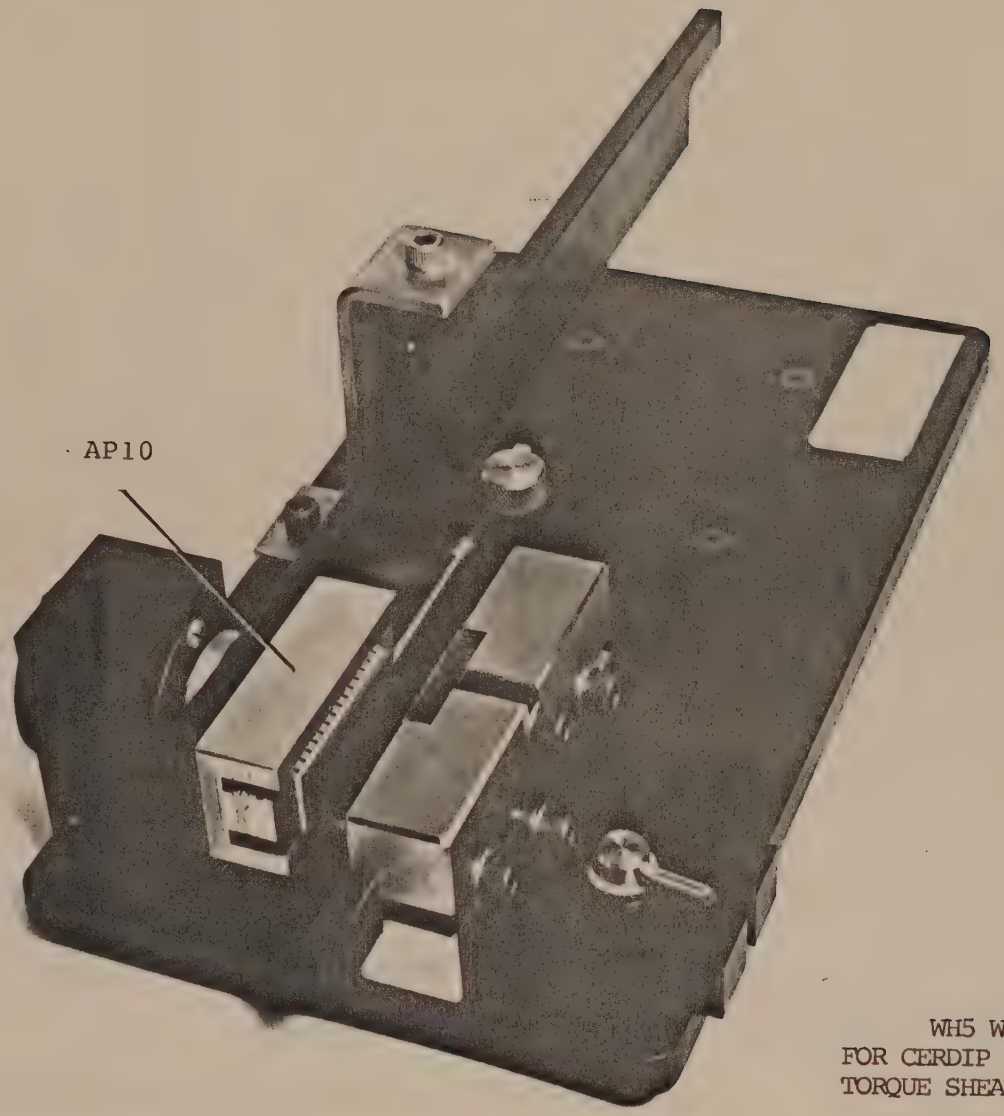

Adaptor Plate
Greaseplate
Rotation
WH7 JOYSTICK
HORIZONTAL WORKHOLDER
BASE UNIT

Fig.18.



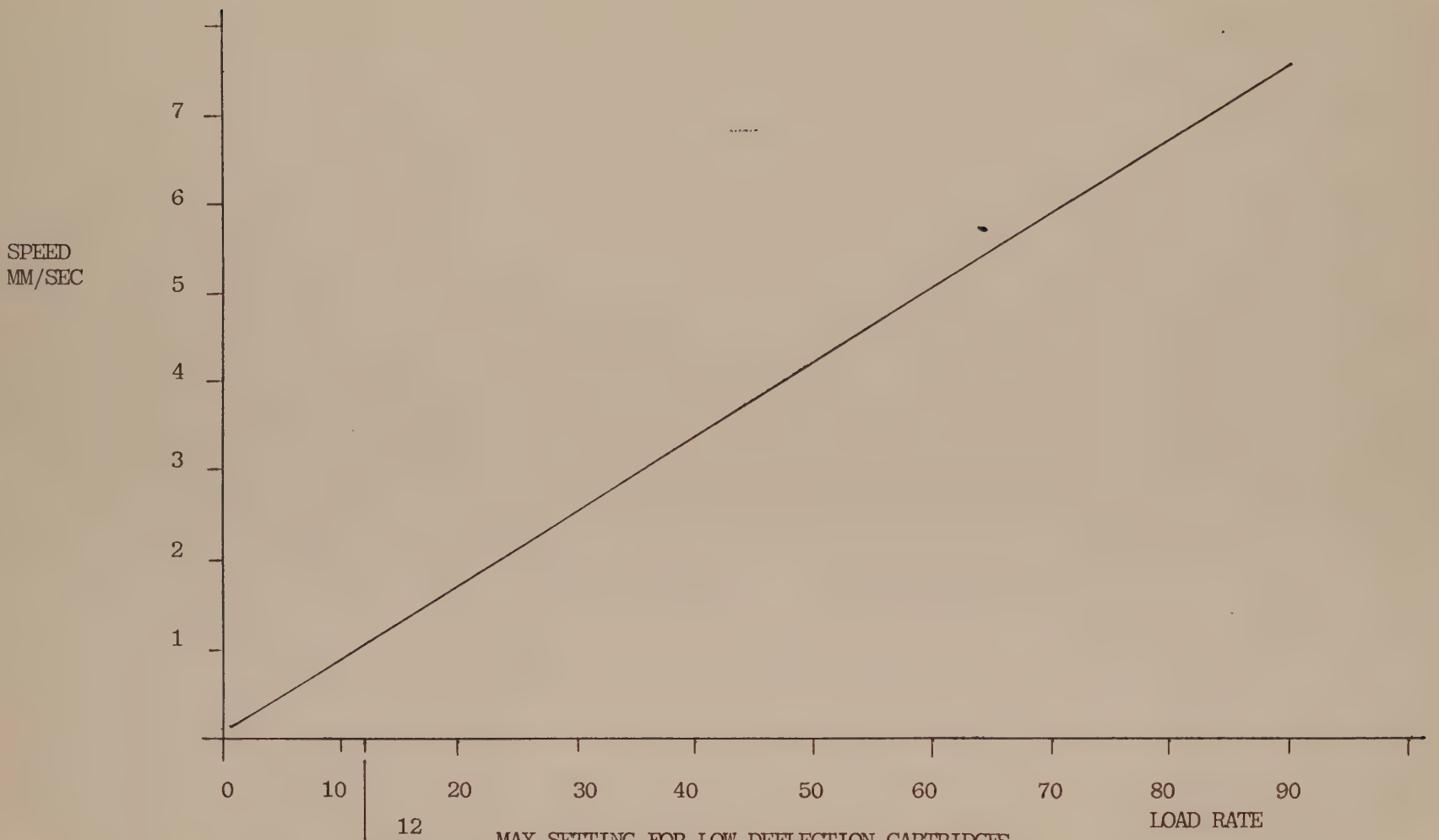
WH3 MICROMETER
X.Y.θ BASE UNIT

Fig.19.



WH5 WORKHOLDER
FOR CERDIP TOP CERAMIC
TORQUE SHEAR TEST

Fig.20.



PLOT OF LOAD CARTRIDGE CARRIAGE SPEED DURING TEST
VERSUS
LOAD RATE SETTING (DIGITIZED VALUE, SELF TEST 1 ROUTINE).

FIG 21

FIG 2

15. LUBRICATION

15.1. Leadscrew

Lubricate periodically with LUBRIPLATE 130-AA

15.2 DO NOT LUBRICATE LINEAR SLIDE BEARINGS.

MP MASTER
MA32756